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UNITED STATES DEPARTMENT OF AGRICULTURE

In Cooperation with the
Idaho, Iowa, Kansas, Missouri, and Washington
Agricultural Experiment Stations and the Brooklyn Botanic Garden

DEPARTMENT BULLETIN No. 1275

Washington, D. C. ▼ April, 1925

VARIETAL SUSCEPTIBILITY OF OATS TO LOOSE AND COVERED SMUTS

By

GEORGE M. REED, Curator of Plant Pathology, Brooklyn Botanic Garden, formerly Pathologist in Charge of Cereal-Smut Investigations, and MARION A. GRIFFITHS and FRED N. BRIGGS, Assistant Pathologists, Office of Cereal Investigations, Bureau of Plant Industry

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By GEORGE M. REED, *Curator of Plant Pathology, Brooklyn Botanic Garden,* formerly *Pathologist in Charge of Cereal-Smut Investigations,* and MARION A. GRIFFITHS and FRED N. BRIGGS, *Assistant Pathologists, Office of Cereal Investigations, Bureau of Plant Industry*

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INTRODUCTION

In recent years numerous investigations have been undertaken to determine the resistance of varieties of economic plants to various diseases. The importance of disease-resistant varieties in the prevention of losses caused by parasitic organisms has long been emphasized, and their discovery and utilization is a well-recognized method of plant-disease control.

The investigations,[2] the results of which are presented in this bulletin, are a continuation and expansion of those previously conducted by the senior writer at the Missouri Agricultural Experiment Station.

REVIEW OF LITERATURE

Previous to a recent publication by the senior writer (*13*)[3] very little study had been made of the resistance of oat varieties to loose smut, *Ustilago avenae* (Pers.) Jens., and covered smut, *U. levis* (K. and S.) Magn. Slight variations in the percentage of smut infection in different varieties of oats were noted by Arthur (*2*), in New York. The infection varied considerably, and none of the varieties was entirely free. Plumb (*12*) recorded from 1 to 3 per

[1] Issued also as Brooklyn Botanic Garden Contributions No. 34.

[2] The writers desire to acknowledge the valuable assistance in conducting these experiments which they have received from Supt. L. C. Aicher, formerly of the Aberdeen, Idaho, substation; Dr. I. E. Melhus, of the Iowa station; Prof. J. H. Parker and Prof. L. E. Melchers, of the Kansas station; Dr. W. E. Maneval, of the Missouri station; and Dr. E. F. Gaines, of the Washington station, as well as from others mentioned later in the text. Miss Naomi Howells rendered valuable assistance in connection with the experiments at the Brooklyn Botanic Garden.

[3] Serial numbers (*italic*) in parentheses refer to "Literature cited," at the end of this bulletin.

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cent of smut in the Racehorse variety when inoculated kernels were sown, as compared with more than 9 per cent in White Australian oats grown under similar conditions.

Jensen (*8*), in Denmark, recorded the percentage of smut infection in 22 varieties of oats during 1885, 1886, and 1887. In 1885 the highest percentage of infection recorded was 28, and several varieties were entirely free. The next year the highest percentage of smut was 45, and practically all the varieties were infected to a greater or less extent. In 1887 the highest percentage of smut was 75, and all the cultivated varieties were infected. No special efforts were made to inoculate the seed, and the results indicated clearly that in successive years there was greater contamination of the seed of the different varieties. As no artificial inoculation of the seed was made, the experiments are not convincing as to the comparative resistance of the varieties. It may be noted, however, that the variety Blainsly in general showed the highest percentage of infection and further that *Avena strigosa* Schreb., grown during these same years, remained entirely free from infection.

Kellerman and Swingle (*10*) mention differences in the prevalence of smut in a few varieties of oats. They quote Bartholomew to the effect that the earlier and colored varieties, such as Red Texas and Black Winter, suffer more than the white varieties. Hickman (*5*, *6*), in Ohio, has recorded the prevalence of smut in a number of varieties of oats, most of which showed from 1 to 10 per cent of infection. Many varieties, however, showed higher percentages of smut, and none proved entirely free. Hickman also noted the increase of smut in the varieties in successive years, due to the increased contamination of the seed. Selby (*16*) also has recorded the occurrence of smut in oats. All of the 27 varieties recorded by him generally showed high percentages of infection. Jones (*9*) noted the occurrence of smut in oat varieties in Vermont and found considerable variation in its prevalence in different varieties, none showing any striking evidences of resistance. Shamel (*17*) records the percentage of smut in 34 varieties grown at the Illinois Agricultural Experiment Station in 1900. The infection varied from 1 to 22 per cent.

Zavitz (*23*, *24*, *25*) has noted the marked freedom of Early Ripe (Burt) oats from smut. In 1906 he sowed treated seed of five varieties of oats, all of which remained free from smut. These varieties were then grown from 1907 to 1914, inclusive, without further seed treatment. No efforts were made to inoculate the seed, and any smutted plants that appeared in the plats as a result of chance contamination were removed before harvest. During these years as a result of chance contamination there was a very marked increase in the percentage of smut in Black Tartarian and small percentages in Joanette, Siberian, and American Banner. On the other hand, in Early Ripe only one smutted head was found in 1913 and two in 1914.

Various agricultural experiment stations in bulletins or reports make more or less casual reference to the prevalence of smut in different varieties of oats. In most cases these records have more significance in indicating the varying degrees of contamination of seed than in indicating the possession of resistance on the part of certain varieties.

Tubeuf (*19*) inoculated 25 varieties of oats with the spores of *Ustilago avenae* and found great differences in the percentages of smut which developed. With one exception (*Avena sativa* var. *aristata*) all the varieties were infected. In a second experiment he grew six varieties, and all of them proved to be more or less susceptible. In this experiment *A. sativa aristata* was severely attacked. The Hopetown variety gave the highest percentage of infection in both experiments.

Rose (*14*) carried out an experiment with carefully inoculated seed, in which he used 63 varieties and sowed two lots of seed of each, one early in the season and the other late. Wide differences were noted in the percentage of smut in the different varieties. They showed infection varying from 1.76 to 17.67 per cent. Two varieties, Schwarzer Brie and Oderbrucher, gave negative results. In general, a higher percentage of infection was obtained in the later seeding.

Appel and Gassner (*1*) mention the fact that Fichtelgebirgs and other mountain varieties of oats are much more susceptible to smut than Ligowa. Hiltner (*7*) also refers to the great susceptibility of Fichtelgebirgs oats as compared with Ligowa.

McAlpine (*11*) successfully infected both wild and cultivated oats with spores of *Ustilago avenae* from wild oats. He also infected wild oats with spores from cultivated oats.

In a previous publication the senior writer (*13*) has described his experiments on the resistance and susceptibility of species and varieties of Avena to both the loose and the covered smut. The experiments with *Ustilago avenae* extended over a period of five seasons, during which 154 agronomic varieties and strains belonging to seven species of Avena were grown. These agronomic strains and varieties were distributed as follows: *Avena brevis* Roth, 3; *A. fatua* L., 3; *A. nuda* L., 4; *A. sativa* L., 99; *A. sativa orientalis* L., 24; *A. sterilis* L., 18; and *A. strigosa* Schreb., 3. The experiments with *Ustilago levis* were continued during four seasons, and 146 agronomic strains and varieties belonging to the same seven species of Avena were grown. The strains and varieties were the same with the exception that six strains of *A. sativa* and two of *A. sativa orientalis* were omitted.

It was found that all the strains of the species *Avena brevis* Roth and *A. strigosa* Schreb. were entirely free from infection. In the experiments with *Ustilago avenae* 995 plants of *A. brevis* and 1,247 plants of *A. strigosa* were grown. In the experiments with *U. levis* 996 plants of *A. brevis* and 1,010 of *A. strigosa* were grown.

Avena fatua L. proved quite susceptible to both smuts. The infection with *Ustilago avenae* varied from 26.9 to 38 per cent and with *U. levis* from 17.4 to 60.7 per cent.

All the strains of *Avena nuda* L. proved extremely susceptible. The percentages of infection obtained usually were very high and in general averaged above 50 per cent.

All the varieties and strains of *Avena sativa orientalis* L. were moderately susceptible. Infection rarely exceeded 50 per cent, but the average for all the different varieties was above 25 per cent.

The large number of strains and varieties of *Avena sativa* L. showed a considerable range in the degree of susceptibility to both smuts. A few varieties, of which Canadian, Early Champion, and Victor are the best illustrations, proved very susceptible, but most varieties showed only moderate percentages of infection. A few, for example,

mutica (No. 45) and *aurea* (No. 7), gave low percentages of infection. Two strains of Black Mesdag (Nos. 70 and 117) consistently showed negative results.

The varieties of *Avena sterilis* L. have proved to be only slightly susceptible to both smuts. Three strains of Burt (Nos. 67, 175, and 253) have consistently showed very low percentages of infection with both loose and covered smuts. Two other strains (Nos. 74 and 75), the latter listed under the name of Early Ripe, proved to be somewhat more susceptible, particularly to *Ustilago avenae*. The variety Fulghum proved to be exceptionally resistant, only 5 infected plants being obtained out of a total of 491 grown from seed inoculated with *U. levis*, while in the series inoculated with *U. avenae* 499 plants were grown, of which 2 were infected. The other varieties of *A. sterilis*—Italian Rustproof, *ludoviciana*, *nigra*, Selection, and Turkish Rustproof—showed either negative results or low percentages of infection.

It is noteworthy that the various strains and varieties used responded similarly to inoculation with the two smuts. As a rule no important differences in the infective capacity of the two smuts were observed. In a given year one variety may have been infected slightly or not at all by one of the smuts and severely by the other, but in the following year the relations may have been reversed. It is especially noteworthy that the highly susceptible varieties, such as *Avena nuda* and *A. sativa* var. Canadian and var. Victor, were equally susceptible to both smuts, the highly resistant varieties, such as *A. sativa* var. Black Mesdag and *A. sterilis* var. Fulghum, were equally resistant to both smuts, and varieties that consistently showed negative results with one smut behaved similarly toward the other.

Heald (*4*) recently reported his results with 19 varieties of oats inoculated with the spores of *Ustilago levis*. Three varieties of hull-less oats (*Avena nuda*) had more than 87 per cent of infection. Infections ranging from 27.5 to 73.2 per cent were shown in 14 varieties, mainly *A. sativa* types. Two varieties showed negative results. One of these, Texas Red, belongs to the *A. sterilis* group, and the other, Kherson, belongs to the *A. sativa* group.

Vavilov (*20*) has reported his observations on the behavior of a large number of varieties of oats with reference to *Ustilago avenae*. His results are briefly summarized in Table 1.

TABLE 1.—*Observations of Vavilov on the behavior of certain varieties of oats with reference to Ustilago avenae*

Oat varieties	Number of strains	Remarks
Avena barbata Pott	4	1 susceptible, 1 immune, 2 in which the stamens only were infected.
brevis Roth	1	Immune.
byzantina C. Koch = A. algeriensis Trabut	2	Do.
clauda Dur	2	Susceptible.
diffusa Aschr. and Graeb. = A. sativa L.	63	56 susceptible, 6 resistant, 1 immune
fatua L.	8	Susceptible.
ludoviciana Dur	4	Do.
nuda L.	2	1 susceptible, 1 resistant.
orientalis Schreb	15	Susceptible.
pilosa M. Bieb	1	Do.
sterilis L.	3	Do.
strigosa Schreb	4	3 immune, 1 susceptible.
wiestii Steud	1	Susceptible.

Vavilov's results coincide very closely with those obtained by the senior writer. The resistant and susceptible strains and varieties are similarly distributed among the different species. It is especially interesting that the only immune variety of *Avena sativa* (*A. diffusa*) observed by Vavilov is Mesdag, which appears to be identical with the variety Black Mesdag which proved so free from smut in the experiments of the senior writer. In his field experiments Vavilov found this variety entirely free from smut, but under greenhouse conditions he was able to obtain an occasional smutted plant. Vavilov also records resistance to loose smut in *A. nuda* var. *biaristata*. This variety, unlike the other varieties of *A. nuda* investigated, is characterized by 14 to 16 chromosomes. Vavilov also records that one strain of *A. strigosa* proved to be susceptible to loose smut. This strain, however, also is genetically different from the ordinary races of this species and can be readily crossed with varieties of *A. sativa*.

Stapledon (*18*) has noted the prevalence of smut in the varieties of oats at the Welsh Plant Breeding Station at Aberystwyth. His results are much more significant on the question of contamination of seed than on the problem of varietal resistance. It should be noted, however, that Welsh Strigosa, belonging to the *Avena strigosa* group, produced some smutted plants.

Sampson and Davies (*15*) have recorded the occurrence of *Ustilago avenae* on 31 varieties in the experimental plats at Aberystwyth, Wales. Fifteen of these, among them the varieties Culberson, Black Mesdag, Golden Rain, and Black Mogul, appeared to be quite susceptible. According to these investigators, *U. levis* is rare in Wales, having been found in the experimental plats only on *Avena nuda* var. *chinensis* and *A. strigosa* subspecies *glabrescens* and *orcadensis*. They carried out an experiment in which they inoculated eight varieties of oats with spores of *U. levis* from Orkney Strigosa. They obtained infection on Orkney Strigosa, but the other seven varieties—Algerian Sterilis, Welsh Strigosa, Ceirch du Bach, Black Tartar, Golden Rain, Radnorshire Sprig, and Potato—gave negative results. However, according to their other records these varieties are infected severely by *U. avenae*.

In comparing the results of Sampson and Davies with those previously obtained by the senior writer, the most important difference is the occurrence of smut on Black Mesdag and the different varieties of *Avena strigosa*. It is not unlikely that different strains of certain varieties of oats may vary in their susceptibility to smut. The senior writer has received from the Welsh Plant Breeding Station its varieties of *A. strigosa* and has found that they are quite different in appearance from those with which he has worked. It is evident that there are varieties and strains of *A. strigosa* which are susceptible to oat smut and others which are highly resistant.

CHARACTERISTICS OF THE OAT SMUTS

There are two distinct species of smuts which attack oats—the loose smut, *Ustilago avenae* (Pers.) Jens., and the covered smut, *U. levis* (K. and S.) Magn. The principal morphological distinction between them is found in the character of the spores. The spores of loose smut are minutely echinulate, while those of the covered smut are entirely smooth. The spores of both are about the same size and shape and are somewhat lighter colored on one side.

The two species also may be distinguished by their pathological effects upon the host. The loose smut causes a very complete destruction of the kernel and inclosing glumes. Soon after the oat panicle emerges from the boot the black, dusty spores with the remnants of the host tissues are disseminated, leaving the naked, slightly branched rachis. The infected heads in the crop appear before or with the normal heads. The covered, or hidden, smut also causes the destruction of the kernel, but the protecting glumes are less involved, remaining more or less intact and partially concealing the smut spore masses. There is very little dissemination of the spores in the field, so that the infected panicles and their spores are harvested with the sound grain. The smutted heads appear simultaneously with or usually a little later than the normal heads (Pl. I).

The life histories of the two species are in general quite similar. Both parasites penetrate the very young seedlings of the host. The mycelium grows in the embryonic host tissues, and the spores are produced in the ovaries and adjacent structures.

It is probable that the loose smut is disseminated very largely by spores which reach the kernel during its development in the field. Jensen (*8*) has emphasized the possible importance of the spores present between the kernel and the protecting husks. Zade (*22*) has recently shown that the spores of the loose smut may germinate in the developing flower and form a rudimentary mycelium in the outer tissues of the kernel or in the adjacent glumes. This type of flower infection, however, is very different from typical flower infection as found in *Ustilago tritici* and *U. nuda*. Whatever may be its importance in the development of smut or whatever may be the importance of spores inclosed by the husks, it is evident from numerous inoculation experiments that high percentages of infection of oats may be obtained by dusting the dry spores on the outside of the grain.

The dissemination of the spores of the covered smut takes place very largely in harvesting, threshing, and similar operations. The spores are separated from the inclosing tissues and scattered over the adjacent sound kernels.

FIELD EXPERIMENTS

EXPERIMENTAL PROCEDURE AND RESULTS

The investigations of the senior writer on the varietal resistance and susceptibility of oats to loose and covered smuts have been continued in the United States Department of Agriculture in cooperation with a number of State agricultural experiment stations and later at the Brooklyn Botanic Garden, Brooklyn, N. Y. The experiments under way at the Missouri Agricultural Experiment Station at Columbia were continued. Extensive sowings were made at Aberdeen, Idaho, in cooperation with the Idaho Agricultural Experiment Station in 1919 and 1920. In cooperation with the Iowa Agricultural Experiment Station, similar studies were carried on at Ames in 1919 and 1920. Sowings also were made at the Kansas Agricultural Experiment Station at Manhattan in 1920 and at the Washington Agricultural Experiment Station at Pullman in the same year. At Pullman the seed sown was inoculated with the covered smut (*Ustilago levis*) only. At all the other stations both smuts were used for inoculating the seed.

USTILAGO INFECTION OF OATS

A, Ustilago avenae (Pers.) Jens. on *Avena sativa* L. var. Victor (natural size); *B, Ustilago levis* (K. and S.) Magn. on *Avena sativa* L. var. Victor, partially smutted head (two-thirds natural size); *C, Ustilago levis* (K. and S.) Magn. on *Avena sativa* L. var. Victor, completely smutted head (two-thirds natural size)

The methods employed were similar in all essentials to those previously described. The varieties were grown in rod rows, and the usual method was to have three plats arranged side by side. The seed inoculated with *Ustilago avenae* was sown in one plat, uninoculated seed was sown in the central plat, and seed inoculated with *U. levis* in the third plat.

Certain varieties also were used as checks and were repeated frequently in the series of varieties and strains. Victor and Canadian, varieties of *Avena sativa*, and some variety of *A. nuda* commonly were used as such checks, because of their marked susceptibility to the smuts. Fulghum, a variety of *A. sterilis*, and Black Mesdag, a variety of *A. sativa*, were included because of their high degree of resistance. Generally some strain of *A. brevis* and *A. strigosa* also were included as checks. The use of these checks served a twofold purpose. If the susceptible check varieties had consistently high percentages of infection throughout the plat, it made possible more definite conclusions regarding the resistance of the other varieties. On the other hand, the highly resistant strains were given all possible opportunity to become infected.

The spores used in the foregoing experiments usually were obtained from a plat of some variety of *Avena nuda* and kept over until the following season.

The seed to be sown was placed in small packets, each sufficient for sowing a rod row. The endeavor was to bring to maturity somewhere between 75 and 100 plants to the row. Accordingly, the seed was not sown as thickly as is ordinarily the rule in oat nurseries. A small quantity of the spores of *Ustilago avenae* was placed in each packet of one lot and mixed with the seed by a thorough shaking. In a similar fashion the seed in the third lot of packets was inoculated with spores of the covered smut. The seed for the second lot was not inoculated.

The data were collected as soon as possible after the varieties began to head. Consequently, by the time the oats in the check plat were mature practically all of the rows in the inoculated plats had been removed.

The seed was obtained from a number of sources. Many of the varieties originally came from Doctor Bubák, at the time Director of the Botanical Garden at Tabor, Bohemia. Dr. W. C. Etheridge furnished practically a complete set of the varieties which he described in his memoir on the classification of oats. A very large collection of varieties has been furnished by T. R. Stanton, agronomist in charge of oat investigations, United States Department of Agriculture. The writers are especially indebted to Mr. Stanton for a great deal of assistance in identifying the different varieties grown in the experiments. Prof. J. H. Parker, of the Kansas Agricultural Experiment Station, and Dr. C. E. Leighty, of the Office of Cereal Investigations, United States Department of Agriculture, each furnished a few varieties.

The results obtained are presented in Table 2. In this table the species are arranged in alphabetical order, with the varieties similarly grouped under each species. The "S. N." numbers recorded are those of a series used by the senior writer in the nurseries of his previous experiments. A variety having a Cereal Investigations accession number has that number added for further identification.

Table 2 records the counts of the total number of plants, the number infected, and the percentage infected at all stations except Manhattan, Kans. At the Kansas station no plant counts were made, and accordingly the data recorded in the table are based on the panicle counts.[4] Records were taken at all the other stations on the total number of panicles and the number infected, but these data are not included in the table. In general, the percentage of smut calculated on the basis of infected panicles is considerably lower than that calculated on the basis of infected plants. This is explained by the fact that a considerable number of plants are only partially smutted and so bear both sound and smutted panicles. All partially smutted plants shown in the table, however, are recorded as infected.

For purposes of comparison the previously published data obtained at Columbia, Mo., are included. Some corrections in varietal names have been made, and the data from a few strains which were found to be mixed are omitted.

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*

[Where two circled figures follow the name of a station (Columbia, column 2) the first one indicates the number of years that the variety was grown in the series with *Ustilago avenae* and the second one the number of years it was grown in the *U. levis* series. A single circled figure indicates that the variety was grown in both series the number of years thus indicated.]

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena brevis:							
S. N. 1	Columbia ④②	278	0	0	405	0	0
	Columbia ④③	490	0	0	347	0	0
	Columbia, 1920	80	0	0	80	0	0
S. N. 77	Ames, 1920	472	0	0	492	0	0
	Aberdeen, 1920	72	0	0	130	0	0
	Brooklyn, 1921	118	0	0	78	0	0
	Brooklyn, 1922	166	0	0	157	0	0
S. N. 134	Columbia ③	227	0	0	244	0	0
	Columbia, 1920	60	0	0	60	0	0
	Ames, 1920	132	0	0	143	0	0
	Aberdeen, 1919	176	0	0	127	0	0
	Aberdeen, 1920	280	0	0	76	0	0
	Manhattan, 1920	111	0	0	171	0	0
	Pullman, 1920				94	0	0
S. N. 139	Brooklyn, 1921	691	0	0	433	0	0
	Brooklyn, 1922	190	0	0	219	0	0
	Aberdeen, 1919	24	0	0			
S. N. 142	Columbia, 1920	60	0	0	60	0	0
	Ames, 1919	173	0	0	57	0	0
	Ames, 1920	151	0	0	170	0	0
	Aberdeen, 1919	58	0	0	45	0	0
	Aberdeen, 1920	112	0	0	80	0	0
	Manhattan, 1920	329	1	.3	419	0	0
	Pullman, 1920				61	0	0
S. N. 289, C. I. 1783 (late-maturing strain).	Brooklyn, 1921	157	0	0	90	0	0
	Brooklyn, 1922	223	0	0	86	0	0
	Columbia, 1920	37	0	0	50	0	0
	Ames, 1920	109	0	0	142	0	0
	Aberdeen, 1919	33	0	0	65	0	0
	Aberdeen, 1920	40	0	0	114	0	0
	Manhattan, 1920	77	0	0	113	0	0
	Pullman, 1920				104	0	0
	Brooklyn, 1921	140	0	0	87	2	2.3
	Brooklyn, 1922	491	0	0	454	2	.4

[4] In all cases where totals have been given the counts have excluded the figures for Manhattan.

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena fatua:							
S. N. 143	Columbia ①, Aberdeen, 1920	50	19	38.0	51	31	60.7
	Aberdeen, 1920	57	28	49.1			
	Brooklyn, 1921	103	37	35.9	45	17	37.7
	Brooklyn, 1922	74	5	6.7	54	14	25.9
S. N. 290, C. I. 1779	Columbia, 1920	30	5	16.6	34	17	50.0
	Ames, 1920	51	21	41.1	72	62	86.1
	Aberdeen, 1919	32	6	18.7	24	10	41.6
	Aberdeen, 1920	74	50	67.5	33	31	93.9
	Manhattan, 1920	49	19	38.7	48	14	29.1
	Pullman, 1920				57	38	66.7
	Brooklyn, 1921	87	39	44.8	45	25	55.5
	Brooklyn, 1922	71	0	0	72	19	26.3
S. N. 375	Ames, 1920	88	34	38.6	75	56	74.6
Avena ludoviciana:							
S. N. 72 (a variety with typical prostrate habit).	Brooklyn, 1921	55	0	0	60	0	0
S. N. 80	Columbia ③②, Aberdeen, 1920	296	18	6.0	193	30	15.5
	Aberdeen, 1920	42	0	0			
	Brooklyn, 1921	90	3	3.3	77	12	15.5
S. N. 176	Columbia ①, Aberdeen, 1919	29	0	0	23	0	0
	Aberdeen, 1919	15	1	6.6			
	Aberdeen, 1920	57	12	21.0	35	11	31.4
	Pullman, 1920				12	0	0
S. N. 180, C. I. 1780 (white-grained strain).	Brooklyn, 1921	54	7	12.9	51	1	1.9
	Brooklyn, 1922	51	0	0	36	0	0
	Columbia, 1920	11	0	0	27	7	25.9
	Aberdeen, 1919	45	1	2.2			
	Aberdeen, 1920	30	2	6.6	33	10	30.3
	Brooklyn, 1921	67	2	2.9	48	6	12.5
	Brooklyn, 1922	81	0	0	46	1	2.1
S. N. 291, C. I. 1781	Columbia, 1920	39	3	7.6	95	12	12.5
	Ames, 1920	95	12	12.6	82	11	13.4
	Aberdeen, 1919	36	7	19.4	61	16	26.2
	Aberdeen, 1920	85	21	24.7	93	22	23.6
	Manhattan, 1920	106	16	15.1	91	14	15.3
	Pullman, 1920				90	25	27.8
	Brooklyn, 1921	64	17	26.5	64	21	32.8
	Brooklyn, 1922	80	3	3.7	66	7	10.6
Avena nuda:							
Var. biaristata, S. N. 181, C. I. 1769. [a]	Aberdeen, 1920	102	97	95.0			
Var. biaristata, S. N. 293, C. I. 1770.	Columbia, 1920	32	26	81.2			
	Ames, 1920	244	242	99.1	252	249	98.8
	Aberdeen, 1919	57	49	86.0	49	48	97.9
	Aberdeen, 1920	76	76	100	101	101	100
	Manhattan, 1920	116	115	99.1	70	67	95.7
	Pullman, 1920				67	67	100
Var. inermis, S. N. 26 [b]	Brooklyn, 1921	429	414	96.5	335	328	97.9
	Brooklyn, 1922	258	26	10.0	148	97	65.9
	Columbia ③②, Aberdeen, 1920	324	288	88.8	122	49	40.1
	Aberdeen, 1920	7	7	100			
Var. inermis, S. N. 30 [c]	Columbia ⑤②, Columbia, 1920	505	344	68.1	183	104	57.3
	Columbia, 1920	136	71	52.2	135	88	65.1
	Ames, 1919	124	75	60.4	242	43	17.7
	Ames, 1920	268	170	63.4	156	130	83.3
	Aberdeen, 1919	258	215	83.3	273	245	89.7
	Aberdeen, 1920	1,002	933	93.1	633	567	89.5
	Manhattan, 1920	464	439	94.6	353	340	96.3
	Pullman, 1920				372	272	73.1
Var. inermis, S. N. 144	Brooklyn, 1921	440	402	91.3	354	311	87.8
	Brooklyn, 1922	750	166	22.1	809	619	76.5
	Columbia ①, Aberdeen, 1920	103	51	49.5	99	65	65.6
	Aberdeen, 1920	69	64	92.7	55	37	67.2
	Brooklyn, 1921	91	73	80.2	97	58	59.7
	Brooklyn, 1922	196	6	3.0	164	41	25.0

[a] This variety differs from No. 293 in possessing dark-colored palæ.
[b] A larger, more robust awnless type received under the name Elegantissima.
[c] This variety was received under the name *Avena chinensis* Fischer. According to Koernicke and Werner, the Chinese hull-less oat should have one awn on the lowest flower.

96995°—25†——2

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena nuda—Continued.	Columbia, 1920	52	34	65.3	32	26	81.2
	Ames, 1920	187	150	80.2	191	187	97.9
Var. inermis, S. N. 294, C. I. 1768.	Aberdeen, 1919	48	42	87.5	40	40	100
	Aberdeen, 1920	104	102	98.0	106	106	100
	Manhattan, 1920	692	680	98.2	447	435	97.5
	Pullman, 1920				289	278	96.2
Liberty, S. N. 292, C. I. 845.	Brooklyn, 1921	121	109	90.0	86	85	98.8
	Brooklyn, 1922	616	139	22.5	520	456	87.6
	Columbia, 1920	32	22	68.7	56	25	44.5
	Ames, 1920	541	304	56.1	484	285	58.8
	Aberdeen, 1919	138	93	67.3	84	73	86.9
	Aberdeen, 1920	90	71	78.8	124	94	75.8
	Manhattan, 1920	103	93	90.3	118	104	88.1
	Pullman, 1920				168	118	70.2
Avena sativa: Abundance, S. N. 269, C. I. 731.	Brooklyn, 1921	233	219	93.9	192	179	93.2
	Brooklyn, 1922	174	5	2.8	130	64	49.2
	Columbia, 1920	72	8	11.1	87	26	29.8
	Ames, 1919	255	60	23.5	309	50	16.1
	Ames, 1920	93	15	16.1	73	14	19.1
	Aberdeen, 1919	193	21	10.8	239	44	18.4
	Aberdeen, 1920	156	20	12.8	134	53	39.5
	Manhattan, 1920	38	14	36.8	37	10	27.0
	Pullman, 1920				207	80	38.6
Albion, S. N. 270, C. I. 729.	Brooklyn, 1921	99	43	43.4	55	20	36.3
	Columbia, 1920	36	1	2.7	71	9	12.5
	Ames, 1919	176	20	11.3	140	15	10.7
	Ames, 1920	227	15	6.6	243	29	11.9
	Aberdeen, 1919	112	6	5.3	108	16	14.8
	Aberdeen, 1920	400	59	14.7	263	67	25.4
	Pullman, 1920				86	33	38.4
Var. aristata, S. N. 35.	Brooklyn, 1921	117	46	39.3	63	18	28.5
	Manhattan, 1920	185	34	18.3	257	77	29.9
	Columbia ③	277	23	8.2	254	33	16.9
	Columbia, 1920	91	3	3.2	108	6	5.5
	Ames, 1919	92	10	10.8	87	5	5.7
	Ames, 1920	115	11	9.5	89	7	7.8
	Aberdeen, 1919	84	6	7.1	96	8	8.3
	Aberdeen, 1920	4	0	0	132	27	20.4
	Manhattan, 1920	66	21	31.8	44	3	6.8
	Pullman, 1920				81	8	9.9
Var. aurea, S. N. 7.	Brooklyn, 1921	88	3	3.4	47	4	8.5
	Brooklyn, 1922	86	0	0	89	5	5.6
	Columbia ③	206	14	6.7	204	21	10.2
	Ames, 1919	15	0	0	18	0	0
	Aberdeen, 1920	113	12	10.6			
Var. aurea, S. N. 328, C. I. 1772.	Columbia, 1920	65	1	1.5	80	0	0
	Ames, 1920	78	3	3.8	92	0	0
	Aberdeen, 1919	147	2	1.3	102	1	.9
	Aberdeen, 1920	179	1	.5	113	0	0
	Manhattan, 1920	28	4	14.2	37	0	0
	Pullman, 1920				124	0	0
Aurora, S. N. 183, C. I. 831.	Brooklyn, 1921	164	4	2.4	116	1	.8
	Brooklyn, 1922	116	0	0	97	0	0
	Ames, 1920	82	11	13.2	108	0	0
	Aberdeen, 1920	207	61	29.4	128	4	3.1
	Manhattan, 1920	120	30	25.0	149	3	2.0
	Pullman, 1920				100	1	1.0
Awnless Probsteier, S. N. 114, C. I. 1888.	Brooklyn, 1921	110	9	8.1			
	Columbia ②	103	35	33.9	101	17	16.8
	Columbia, 1920	54	5	9.2	95	28	29.4
	Ames, 1920	79	12	15.1	92	34	36.9
	Aberdeen, 1919	95	22	23.1	96	32	33.3
	Aberdeen, 1920	146	32	21.9	192	38	19.7
	Manhattan, 1920	61	25	40.9	62	15	24.2
	Pullman, 1920				166	92	55.4
	Brooklyn, 1921	90	20	22.2	51	7	13.7

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa—Continued. Banner, S. N. 271, C. I. 160.	Columbia, 1920	82	5	6.0	96	16	16.6
	Ames, 1919	292	46	15.7	244	33	13.5
	Ames, 1920	95	17	17.8	67	15	22.3
	Aberdeen, 1919	107	12	11.2	113	22	19.4
	Aberdeen, 1920	160	31	19.3	124	44	35.4
	Manhattan, 1920	52	16	30.7	43	9	29.9
	Pullman, 1920				94	42	44.7
Belyak, S. N. 115	Brooklyn, 1921	94	32	34.0	46	11	23.9
	Columbia ②	108	19	17.5	100	14	14.0
	Columbia, 1920	75	4	5.3	103	47	45.6
	Ames, 1920	90	9	10.0	70	5	7.1
	Aberdeen, 1919	78	17	21.7	63	26	41.2
	Manhattan, 1920	102	39	38.2	89	32	35.9
	Pullman, 1920				149	40	26.8
Belyak, S. N. 306, C. I. 1725 (does not resemble Nos. 115 and 321; not far from Silvermine).	Brooklyn, 1921	98	37	37.7	60	21	35.0
	Columbia, 1920	60	0	0	110	1	.9
	Ames, 1920	82	5	6.0	95	0	0
	Aberdeen, 1919	100	4	4.0	84	0	0
	Manhattan, 1920	52	2	3.8	54	1	1.8
	Pullman, 1920				91	0	0
Belyak, S. N. 321, C. I. 1632 (closely resembles Lincoln).	Brooklyn, 1921	243	15	6.1	170	0	0
	Brooklyn, 1922	123	0	0	89	0	0
	Columbia, 1920	51	4	7.8	59	9	15.2
	Ames, 1920	99	9	9.0	81	25	30.8
	Aberdeen, 1919	62	19	30.6	70	12	17.1
	Aberdeen, 1920	160	36	22.5	146	30	20.5
	Manhattan, 1920	68	23	33.8	97	43	44.3
	Pullman, 1920				96	35	36.5
Bicknell (selection), S. N. 341, C. I. 206–151.	Brooklyn, 1921	94	50	53.1	67	28	41.7
	Ames, 1920	76	4	5.2	75	0	0
	Aberdeen, 1920	105	22	20.9	86	0	0
	Manhattan, 1920	129	20	15.5	204	2	.9
	Pullman, 1920				89	2	2.2
Bicknell (selection), S. N. 342, C. I. 206–155.	Brooklyn, 1921	234	28	11.9	170	5	2.9
	Aberdeen, 1920	136	28	20.5	92	2	2.1
	Manhattan, 1920	82	6	7.3	95	0	0
	Pullman, 1920				107	2	1.9
Big Four, S. N. 272, C. I. 179.	Brooklyn, 1921	113	9	7.9	75	2	2.6
	Columbia, 1920	56	2	3.5	87	16	18.3
	Ames, 1919	303	54	17.8	316	48	15.1
	Ames, 1920	106	19	17.9	68	15	22.0
	Aberdeen, 1919	206	25	12.1	229	30	13.1
	Aberdeen, 1920	79	28	35.4	129	39	30.2
	Manhattan, 1920	43	15	34.8	40	6	15.0
	Pullman, 1920				88	1	1.1
Big Four, S. N. 307, C. I. 1641.	Brooklyn, 1921	104	36	34.6	53	6	11.3
	Columbia, 1920	42	4	9.5	56	14	25.0
	Ames, 1920	105	10	9.5	98	28	28.5
	Aberdeen, 1919	93	10	10.7	123	16	13.0
	Aberdeen, 1920	151	21	13.9	78	40	51.2
	Manhattan, 1920	44	8	18.1	56	11	19.6
	Pullman, 1920				91	39	42.9
Black American, S. N. 185, C. I. 549.	Brooklyn, 1921	90	33	36.6	54	14	25.9
	Columbia, 1920	48	7	14.5	123	44	35.7
	Ames, 1919	131	0	0	205	31	15.1
	Ames, 1920	125	10	8.0	102	27	26.4
	Aberdeen, 1919	127	41	32.2	121	45	37.1
	Aberdeen, 1920	249	18	7.2	152	25	16.4
	Manhattan, 1920	114	22	19.3	106	17	16.0
	Pullman, 1920				160	101	63.1
Black Diamond, S. N. 116, C. I. 1878	Brooklyn, 1921	110	26	23.6	65	15	23.0
	Columbia ②	111	11	9.9	114	4	3.5
	Columbia, 1920	67	14	20.0	60	0	0
	Ames, 1919	134	9	6.7	111	0	0
	Ames, 1920	58	4	6.8	58	2	3.4
	Aberdeen, 1919	95	17	17.5	93	7	7.5
	Aberdeen, 1920	73	10	13.7	90	1	1.1
	Manhattan, 1920	22	1	4.5	25	0	0
	Pullman, 1920				36	1	3.8
	Brooklyn, 1921	174	43	24.7	109	1	.9
	Brooklyn, 1922	76	0	0	72	0	0

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa—Continued.							
Black Mesdag, S. N. 70. (Received under the name *nigra* and so heretofore reported.)	Columbia ③	455	0	0	539	0	0
	Columbia, 1920	185	0	0	227	1	.4
	Ames, 1919	63	0	0	87	0	0
	Ames, 1920	874	0	0	727	1	.1
	Aberdeen, 1919	196	0	0	198	0	0
	Aberdeen, 1920	847	0	0	219	0	0
	Manhattan, 1920	146	0	0	179	0	0
	Pullman, 1920				223	0	0
	Brooklyn, 1921	805	4	.4	656	0	0
	Brooklyn, 1922	339	0	0	351	0	0
Black Mesdag, S. N. 117	Columbia ②	351	0	0	382	0	0
	Columbia, 1920	165	0	0	165	0	0
	Ames, 1919	126	0	0	126	0	0
	Ames, 1920	811	0	0	786	0	0
	Aberdeen, 1919	129	0	0	162	0	0
	Aberdeen, 1920	708	0	0	437	0	0
	Manhattan, 1920	164	0	0	278	4	1.4
	Pullman, 1920				264	0	0
	Brooklyn, 1921	462	0	0	386	0	0
	Brooklyn, 1922	533	0	0	370	0	0
Black Mesdag, S. N. 188, C. I. 1765.	Aberdeen, 1920	39	0	0			
	Brooklyn, 1921	81	0	0	75	0	0
	Brooklyn, 1922	68	0	0	55	0	0
Black Mogul, S. N. 189, C. I. 1759.	Aberdeen, 1920	116	21	18.1			
	Brooklyn, 1921	95	21	22.1	72	5	6.9
	Columbia ①	37	4	10.8	37	0	0
Black Norway, S. N. 118	Aberdeen, 1920	33	0	0			
	Brooklyn, 1921	69	14	20.2	66	0	0
Black Norway, S. N. 186, C. I. 1767.	Aberdeen, 1920	61	6	9.8			
	Brooklyn, 1921	101	18	17.8	72	0	0
	Brooklyn, 1922	70	0	0	87	0	0
Var. brunnea, S. N. 8	Columbia ④	433	69	15.9	322	58	18.0
	Columbia, 1920	117	6	5.1	117	10	8.5
	Ames, 1919	125	6	4.8	151	3	1.9
	Ames, 1920	97	6	6.1	70	3	4.2
	Aberdeen, 1919	128	11	8.5	229	59	25.7
	Aberdeen, 1920	108	25	23.1	85	28	32.9
	Manhattan, 1920	30	8	26.6	25	0	0
	Pullman, 1920				167	40	24.0
	Brooklyn, 1921	117	28	23.9	54	2	3.7
Canadian, S. N. 119	Columbia ②	153	62	40.5	140	101	72.1
	Columbia, 1920	58	3	5.1	85	70	82.2
	Ames, 1919	168	82	48.8	156	80	51.2
	Ames, 1920	70	33	47.1	90	55	61.1
	Aberdeen, 1919	101	40	39.8	90	56	62.2
	Aberdeen, 1920	85	62	72.9	97	65	67.0
	Manhattan, 1920	336	178	52.9	262	125	47.7
	Pullman, 1920				84	77	91.7
	Brooklyn, 1921	536	322	60.0	481	331	68.8
	Brooklyn, 1922	420	102	24.2	477	238	49.8
Canadian, S. N. 190, C. I. 1625.	Aberdeen, 1920	124	68	54.8			
Caucasus, S. N. 279, C. I. 1754.	Ames, 1919	146	0	0	156	0	0
	Aberdeen, 1920	61	1	1.6	78	0	0
	Manhattan, 1920	19	1	5.2	18	0	0
	Brooklyn, 1921	286	6	2.0	230	0	0
	Brooklyn, 1922	65	0	0	76	1	1.3
S. N. 145, C. I. 602	Columbia ③	49	15	30.6	40	0	0
	Ames, 1919	120	6	5.0	35	0	0
	Aberdeen, 1920	95	58	61.0	82	12	14.6
	Manhattan, 1920	17	6	35.3	31	1	3.2
	Brooklyn, 1921	100	16	16.0	53	1	1.8
S. N. 146, C. I. 603	Columbia ①	50	15	30.0	50	27	54.0
	Ames, 1919	75	28	37.3	36	3	8.3
	Aberdeen, 1920	66	32	48.4	82	48	58.2
	Manhattan, 1920	55	24	43.6	41	8	19.5
	Brooklyn, 1921	112	17	15.1	66	13	19.6
S. N. 127, C. I. 606	Columbia ③	172	13	7.5	184	31	16.8
	Aberdeen, 1920	157	24	15.2			
	Brooklyn, 1921	97	10	10.3	90	27	30.0

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa—Continued.	Columbia ①	19	1	5.2	13	7	53.8
S. N. 148, C. I. 620	Aberdeen, 1920	45	9	20.0			
	Brooklyn, 1921	81	10	12.3	73	26	35.6
Clydesdale, S. N. 191, C. I. 1626.	Aberdeen, 1920	116	43	37.0			
	Brooklyn, 1921	103	16	15.5	59	17	28.8
Cornellian, S. N. 398, C. I. 1242.	Brooklyn, 1921	577	31	5.3	541	1	.1
	Brooklyn, 1922	60	4	6.6	48	3	6.2
	Columbia ②	149	63	72.2	139	28	20.1
	Columbia, 1920				50	0	0
Culberson, S. N. 120, C. I. 1873.	Ames, 1920	99	5	5.0	104	47	45.1
	Aberdeen, 1920	74	22	29.3			
	Brooklyn, 1921	330	16	4.8	92	11	11.9
	Columbia ①	235	25	10.6	262	32	12.2
	Columbia, 1920	10	2	20.0	43	3	6.9
	Ames, 1919	272	14	5.1	351	6	1.7
Culberson, S. N. 192, C. I. 273.	Ames, 1920	298	11	3.6	242	25	10.3
	Aberdeen, 1919	324	40	12.3	268	34	12.6
	Aberdeen, 1920	162	38	23.4	187	24	12.8
	Manhattan, 1920	176	40	22.7	197	9	4.5
	Pullman, 1920				160	12	7.5
	Brooklyn, 1921	127	12	9.4	67	5	7.4
Culberson, S. N. 295, C. I. 691.	Columbia, 1920	14	0	0	18	0	0
	Ames, 1920	83	0	0	95	0	0
	Aberdeen, 1919	90	1	1.1	101	2	1.9
Culberson, S. N. 359	Aberdeen, 1920	139	25	17.9	144	1	.6
	Manhattan, 1920	137	17	12.4	187	7	3.7
Culberson (Virginia Gray), S. N. 360.	Aberdeen, 1920	130	5	3.8			
	Manhattan, 1921	115	7	6.0	141	6	4.2
	Brooklyn, 1921	107	13	12.1	79	2	2.5
	Ames, 1919	78	2	2.5	133	1	.7
Culberson (selection), S. N. 193, C. I. 273-V.	Aberdeen, 1920	66	11	16.6	103	6	5.8
	Manhattan, 1920	102	14	13.7	124	0	0
	Brooklyn, 1921	117	3	2.5	85	3	3.5
Culberson (selection), S. N. 194, C. I. 273-41.	Aberdeen, 1920	130	43	33.0			
	Brooklyn, 1921	150	31	20.6	89	24	26.9
Culberson (selection), S. N. 344, C. I. 273-I-10.	Aberdeen, 1920	146	43	29.4	129	27	20.9
	Manhattan, 1920	118	28	23.7	91	1	1.0
	Pullman, 1920				136	42	30.9
Culberson (selection), S. N. 345, C. I. 273-I-14.	Brooklyn, 1921	391	8	2.0	99	11	11.1
	Aberdeen, 1920	115	15	13.0	125	14	11.2
	Manhattan, 1920	69	22	31.8	60	0	0
	Pullman, 1920				104	13	12.5
Danish, S. N. 309, C. I. 1669.	Brooklyn, 1921	148	17	11.4	93	8	8.6
	Columbia, 1920	50	10	20.0	94	1	1.0
	Ames, 1920	131	16	12.2	96	4	4.1
	Aberdeen, 1919	86	39	45.3	94	2	2.1
	Aberdeen, 1920	148	61	41.2	87	0	0
	Manhattan, 1920	62	15	24.2	60	1	1.6
	Pullman, 1920				78	0	0
Danish Island, S. N. 149.	Brooklyn, 1921	120	23	19.1	182	0	0
	Brooklyn, 1922	115	3	2.6	119	0	0
	Columbia ①	43	16	37.2	45	7	15.5
	Ames, 1919	90	27	30.0	29	0	0
	Aberdeen, 1920	124	34	27.4			
	Manhattan, 1920	58	20	34.4	97	4	4.1
	Brooklyn, 1921	123	19	15.4	76	6	7.8
	Brooklyn, 1922	90	1	1.1	72	0	0
Danish Island, S. N. 310, C. I. 1666.	Columbia, 1920	43	3	6.9	109	11	10.0
	Ames, 1920	94	23	24.4	86	23	26.7
	Aberdeen, 1919	58	23	39.6	90	26	28.8
	Aberdeen, 1920	137	47	34.3	100	41	41.0
	Manhattan, 1920	67	33	49.2	45	14	31.1
	Pullman, 1920				89	51	57.3
Danish Island, S. N. 311, C. I. 1684 (appears to be distinct from Nos. 149 and 310).	Brooklyn, 1921	106	17	16.0	63	32	50.7
	Brooklyn, 1922	93	6	6.4	101	34	33.6
	Columbia, 1920	53	1	1.8	87	0	0
	Ames, 1920	114	0	0	82	1	1.2
	Aberdeen, 1919	120	2	1.6	89	3	3.3
	Aberdeen, 1920	171	4	2.3	121	1	.8
	Manhattan, 1920	93	5	5.3	84	4	4.7
	Pullman, 1920				32	1	3.1
	Brooklyn, 1921	363	15	4.1	267	3	1.1
	Brooklyn, 1922	83	0	0	79	1	1.2

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa—Continued.							
Daubeney, S. N. 195, C. I. 1621.	Aberdeen, 1920	83	26	31.3			
	Brooklyn, 1921	134	49	36.5	69	52	75.3
	Ames, 1919	85	0	0	146	0	0
	Ames, 1920	95	9	9.4	87	0	0
Dwarf Culberson, S. N. 196, C. I. 748.	Aberdeen, 1920	234	57	24.3	194	0	0
	Manhattan, 1920	245	38	15.5	323	1	.3
	Pullman, 1920				114	10	8.8
	Brooklyn, 1921	129	7	5.4	65	0	0
	Columbia ①	62	24	38.7	68	56	82.3
Early Champion, S. N. 150.	Aberdeen, 1920	140	84	60.0			
	Brooklyn, 1921	124	52	41.9	95	54	56.8
	Brooklyn, 1922	91	12	13.1	78	13	16.6
	Columbia ①	272	113	41.5	266	114	42.8
	Columbia, 1920	173	25	14.4	311	80	25.7
	Ames, 1919	113	33	29.1	189	6	3.1
	Ames, 1920	844	194	22.9	756	244	32.2
Early Champion, S. N. 197, C. I 1623.	Aberdeen, 1919	241	57	23.5	137	32	23.3
	Aberdeen, 1920	802	341	45.5	674	243	36.0
	Manhattan, 1920	428	241	56.3	429	120	27.9
	Pullman, 1920				591	155	26.2
	Brooklyn, 1921	95	28	29.4	65	30	46.1
	Brooklyn, 1922	88	8	9.0	85	26	30.5
Early Dakota, S. N. 151, C. I. 1895.	Columbia ①	58	17	29.3	55	21	38.1
	Aberdeen, 1920	61	17	27.8			
	Brooklyn, 1921	138	23	16.6	77	22	28.5
	Columbia ①	31	21	67.7	45	1	2.2
	Ames, 1919	52	15	28.8	45	0	0
Early Gothland, S. N. 152.	Aberdeen, 1920	108	43	39.8			
	Manhattan, 1920	68	28	41.1	52	3	5.7
	Brooklyn, 1921	98	26	26.5	54	0	0
	Brooklyn, 1922	68	2	2.9	68	1	1.4
Early Gothland, S. N. 200, C. I. 1723.	Aberdeen, 1920	95	33	34.7			
	Brooklyn, 1921	130	32	24.6	78	0	0
	Brooklyn, 1922	68	2	2.9	97	0	0
Early Mountain, S. N. 201, C. I. 1624.	Aberdeen, 1920	170	29	17.0	95	14	14.7
	Brooklyn, 1921	118	17	14.4	81	23	28.3
	Columbia, 1920	47	8	17.0	110	17	15.4
	Ames, 1919	168	8	4.7	151	2	1.3
	Ames, 1920	98	13	13.2	113	14	12.3
Early Mountain, No. 2, S. N. 273, C. I. 656.	Aberdeen, 1919	282	23	8.1	184	26	14.1
	Aberdeen, 1920	48	19	39.5	101	22	21.7
	Manhattan, 1920	63	7	11.1	76	0	0
	Pullman, 1920				39	9	23.1
	Brooklyn, 1921	128	24	18.7	83	29	34.9
	Columbia ①	30	18	60.0	25	7	28.0
Garton, S. N. 153	Aberdeen, 1920	44	8	18.1			
	Brooklyn, 1921	93	30	32.2	59	14	23.7
	Brooklyn, 1922	73	2	2.7	52	10	19.2
Golden Drop, S. N. 154, C. I. 1890.	Columbia ①	52	11	21.1	48	24	50.0
	Aberdeen, 1920	118	53	44.9			
	Brooklyn, 1921	125	52	41.6	102	42	41.1
	Columbia, 1920	51	4	7.8	84	8	9.5
	Ames, 1920	99	11	11.1	76	18	23.6
Golden Fleece, S. N. 315, C. I. 1749 (closely resembles Golden Rain).	Aberdeen, 1919	110	16	14.5	96	15	15.6
	Aberdeen, 1920	202	31	15.3	139	33	23.7
	Manhattan, 1920	79	21	26.5	66	5	7.5
	Pullman, 1920				76	24	31.6
Golden Rain, S. N. 202, C. I. 1718.	Brooklyn, 1921	102	18	17.6	80	31	38.7
	Aberdeen, 1920	105	57	54.2			
	Brooklyn, 1921	115	52	45.2	103	48	46.6
	Columbia, 1920	45	4	8.8	102	20	19.7
	Ames, 1919	260	27	10.3	264	62	23.4
	Ames, 1920	101	16	15.8	110	21	19.0
Golden Rain, S. N. 275, C. I. 493.	Aberdeen, 1919	283	47	16.6	218	36	16.5
	Aberdeen, 1920	58	37	63.7	98	52	53.0
	Manhattan, 1920	69	21	30.4	59	11	18.6
	Pullman, 1920				78	39	50.0
	Brooklyn, 1921	115	57	49.5	99	34	34.3

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa—Continued. Green Russian, S. N. 121.	Columbia ②	181	45	24.8	195	37	18.8
	Columbia, 1920	58	1	1.7	120	11	9.1
	Ames, 1919	91	15	16.4	122	3	2.4
	Ames, 1920	128	16	12.5	106	10	9.4
	Aberdeen, 1919	189	28	14.8	182	29	15.9
	Aberdeen, 1920	115	24	20.8	150	15	10.0
	Manhattan, 1920	86	23	26.7	60	7	11.6
	Pullman, 1920				142	23	16.2
Green Russian, S. N. 203, C. I. 1683.	Brooklyn, 1921	106	18	16.9	81	26	32.0
	Columbia, 1920	28	0	0	83	6	7.2
	Ames, 1919	301	17	5.6	291	7	2.4
	Ames, 1920	93	14	15.0	90	21	23.3
	Aberdeen, 1919	123	8	6.5	107	11	10.2
	Aberdeen, 1920	147	36	24.4	167	98	58.6
	Manhattan, 1920	59	15	25.4	65	1	1.5
	Pullman, 1920				118	76	64.4
Green Russian, S. N. 276, C. I. 827.	Ames, 1919	167	16	9.5	153	6	3.9
	Ames, 1920	119	6	5.0	102	15	14.7
	Aberdeen, 1920	86	31	36.2	129	42	32.5
	Manhattan, 1920	80	16	20.0	90	21	23.3
	Brooklyn, 1921	115	25	21.7	81	22	27.1
Green Russian, S. N. 313, C. I. 1750.	Columbia, 1920	58	1	1.7	94	8	8.5
	Ames, 1920	140	12	8.5	108	25	23.1
	Aberdeen, 1919	119	9	7.5	120	9	7.5
	Aberdeen, 1920	52	8	15.3	107	18	16.8
	Manhattan, 1920	114	34	29.8	115	17	14.7
	Pullman, 1920				84	17	20.2
Green Russian (Golden Beauty), S. N. 314, C. I. 1748.	Brooklyn, 1921	101	13	12.8	91	22	24.1
	Columbia, 1920	57	4	7.0	56	17	30.3
	Ames, 1920	116	12	10.3	106	16	15.0
	Aberdeen, 1919	113	14	12.3	97	27	27.8
	Aberdeen, 1920	182	26	14.2	186	35	18.8
	Manhattan, 1920	55	12	21.8	44	12	27.2
	Pullman, 1920				86	24	27.9
Green Russian (Golden Rustproof), S. N. 316, C. I. 1751.	Brooklyn, 1921	110	31	28.1	87	30	34.4
	Columbia, 1920	45	0	0	59	2	3.3
	Ames, 1920	108	6	5.5	85	0	0
	Aberdeen, 1919	96	24	25.0	98	0	0
	Aberdeen, 1920	192	15	7.8	135	0	0
	Manhattan, 1920	56	5	9.1	67	0	0
	Pullman, 1920				67	0	0
Var. grisea, S. N. 41	Brooklyn, 1921	363	65	17.9	282	1	.3
	Brooklyn, 1922	96	1	1.0	85	0	0
	Columbia ③ ①	127	30	23.6	110	22	20.0
	Aberdeen, 1920	212	104	49.0			
Hatchett, S. N. 296, C. I. 838.	Brooklyn, 1921	128	72	56.2	94	63	67.0
	Columbia, 1920	39	3	7.6	21	3	14.2
	Ames, 1920	84	5	5.9	110	5	4.5
	Aberdeen, 1919	90	0	0	94	0	0
	Aberdeen, 1920	163	10	6.1	183	4	2.1
	Manhattan, 1920	244	23	9.5	139	6	4.3
	Pullman, 1920				78	1	1.3
Hay, S. N. 317, C. I. 1622.	Brooklyn, 1921	101	1	.9	115	1	.8
	Columbia, 1920	20	5	25.0	50	1	2.0
	Ames, 1920	138	3	2.1	95	14	14.7
	Aberdeen, 1919	69	6	8.6	132	20	15.1
	Aberdeen, 1920	161	7	4.3	142	7	4.9
	Manhattan, 1920	90	22	24.4	128	17	13.2
	Pullman, 1920				74	5	6.8
Heavyweight Champion, S. N. 318, C. I. 1690.	Brooklyn, 1921	115	7	6.0	81	5	6.1
	Columbia, 1920	30	4	13.3	64	10	15.6
	Ames, 1920	109	25	22.9	73	22	30.1
	Aberdeen, 1919	65	23	35.3	100	41	41.0
	Aberdeen, 1920	162	37	22.8	163	59	36.1
	Manhattan, 1920	41	20	48.7	29	12	41.3
	Pullman, 1920				96	50	52.1
Iowar, S. N. 397, C. I. 847.	Brooklyn, 1921	112	40	35.7	97	57	58.7
	Brooklyn, 1921	107	20	18.6	86	14	16.2

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa—Continued.	Columbia ①	45	10	22.2	48	22	45.8
Irish Victor, S. N. 155	Aberdeen, 1920	85	14	16.4			
	Brooklyn, 1921	105	18	17.1	94	19	20.2
Irish Victor, S. N. 204, C. I. 1685.	Aberdeen, 1920	129	14	10.8			
	Brooklyn, 1921	127	10	7.8	88	5	5.6
Irish Victor (Alaska), S. N. 205, C. I. 1735.	Aberdeen, 1920	114	42	36.8			
	Brooklyn, 1921	114	50	43.8	69	28	40.5
Irish Victor (Alaska), S. N. 206, C. I. 1689.	Aberdeen, 1920	117	52	44.4			
	Brooklyn, 1921	129	23	17.8	70	0	0
	Brooklyn, 1922	72	1	1.3	63	0	0
Japan, S. N. 207, C. I. 1693	Aberdeen, 1920	153	49	32.0			
	Brooklyn, 1921	113	21	18.5	85	0	0
	Brooklyn, 1922	112	2	1.7	111	1	.9
Japan Selection (of Etheridge), S. N. 156, C. I. 1889.	Columbia ①	57	33	57.8	79	53	67.0
	Aberdeen, 1920	117	75	64.1			
	Brooklyn, 1921	147	65	44.2	69	40	57.9
	Columbia ②	113	25	22.1	132	23	17.4
	Columbia, 1920	85	0	0	85	0	0
	Ames, 1919	121	2	1.6	90	0	0
	Ames, 1920	111	4	3.6	96	0	0
Joanette, S. N. 125, C. I. 1880.	Aberdeen, 1919	76	9	11.8	91	8	8.7
	Aberdeen, 1920	165	43	26.0	121	1	.8
	Manhattan, 1920	46	0	0	53	1	1.8
	Pullman, 1920				147	2	1.4
	Brooklyn, 1921	276	29	10.5	171	9	5.2
	Brooklyn, 1922	92	0	0	119	8	6.7
Joanette, S. N. 187, C. I. 1762 (closely resembles Black Diamond, S. N. 116).	Aberdeen, 1920	86	1	1.1			
	Brooklyn, 1921	216	2	.9	135	0	0
	Brooklyn, 1922	115	0	0	68	0	0
Joanette, S. N. 208, C. I. 1757.	Aberdeen, 1920	63	20	31.7			
	Brooklyn, 1921	100	6	6.0	76	15	19.7
	Brooklyn, 1922	85	1	1.1	79	11	13.9
June, S. N. 157, C. I. 1902	Columbia ①	35	21	60.0	46	27	58.7
	Ames, 1919	60	15	25.0	58	10	17.2
	Aberdeen, 1920	62	34	54.8			
	Manhattan, 1920	43	15	34.0	29	3	10.3
	Brooklyn, 1921	106	19	17.9	87	8	9.1
Kherson, S. N. 158	Columbia ①	49	21	42.8	25	12	46.1
	Aberdeen, 1920	128	43	33.5			
	Brooklyn, 1921	130	27	20.7	70	4	5.7
Kherson, S. N. 209, C. I. 459.	Aberdeen, 1920	127	9	7.0			
	Brooklyn, 1921	145	16	11.0	86	16	18.6
Kherson Selection (of Etheridge), S. N. 159, C. I. 1905.	Columbia ①	54	24	44.4	59	41	69.4
	Ames, 1919	73	24	32.8	127	16	12.6
	Ames, 1920	90	18	20.0	134	33	24.6
	Aberdeen, 1920	92	49	53.2	104	43	41.3
	Manhattan, 1920	105	50	47.6	97	15	15.4
	Brooklyn, 1921	134	40	29.8	101	34	33.6
Var. krausei, S. N. 9	Columbia ④	174	49	28.1	304	45	14.8
	Columbia, 1920	57	3	5.2	74	12	16.2
	Ames, 1920	102	17	16.6	99	25	25.2
	Aberdeen, 1919	83	22	26.5	86	25	29.0
	Aberdeen, 1920	301	48	15.9	125	56	44.8
	Manhattan, 1920	33	8	24.2	61	14	23.0
	Pullman, 1920				138	8	5.8
	Brooklyn, 1921	119	14	11.7	74	16	21.6
Ligowa, S. N. 277, C. I. 640.	Columbia, 1920	34	5	14.7	94	1	1.6
	Ames, 1919	147	6	4.0	105	17	16.1
	Ames, 1920	83	9	10.8	94	17	18.0
	Aberdeen, 1919	121	9	7.4	105	10	9.5
	Aberdeen, 1920	59	9	15.2	122	34	27.8
	Manhattan, 1920	62	26	42.0	53	17	32.0
	Pullman, 1920				68	14	20.6
	Brooklyn, 1921	105	19	18.0	65	20	30.7
Lincoln, S. N. 160	Columbia ①	48	17	35.4	40	18	45.0
	Aberdeen, 1920	85	31	36.4			
	Brooklyn, 1921	118	25	21.1	68	23	33.8
Lincoln, S. N. 210, C. I. 1744.	Aberdeen, 1920	60	18	30.0			
	Brooklyn, 1921	107	30	28.0	73	24	32.8

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa—Continued.							
Lincoln (Colorado No. 37), S. N. 211, C. I. 1640.	Aberdeen, 1920	65	28	43.0			
	Brooklyn, 1921	103	19	18.4	86	28	32.5
Lincoln (Johnson), S. N. 212, C. I. 1698.	Aberdeen, 1920	92	5	5.4			
	Brooklyn, 1921	114	8	7.0	80	0	0
Lincoln (Kirsche Minnesota No. 343), S. N. 213, C. I. 1695.	Aberdeen, 1920	99	42	42.4			
	Brooklyn, 1921	113	24	21.2	83	28	33.7
Lincoln (Wisconsin Wonder), S. N. 214, C. I. 1711.	Aberdeen, 1920	98	15	15.3			
	Brooklyn, 1921	88	29	32.9	100	10	10.0
	Columbia, 1920	54	8	14.7	99	17	18.1
	Ames, 1919	253	20	7.9	318	56	17.6
	Ames, 1920	93	14	15.0	109	8	7.3
Lincoln (Minnesota No. 26), S. N. 278, C. I. 721.	Aberdeen, 1919	123	12	9.7	96	11	11.4
	Aberdeen, 1920	166	48	28.9	139	62	44.6
	Manhattan, 1920	83	34	40.9	61	14	23.0
	Pullman, 1920				82	29	35.4
	Brooklyn, 1921	85	42	49.4	75	35	46.6
Monarch, S. N. 161	Columbia ①	57	0	0	44	27	61.3
	Ames, 1919	89	5	5.6	131	5	3.8
	Aberdeen, 1920	76	1	1.3	138	64	46.3
	Manhattan, 1920	92	1	1.0	112	31	27.6
	Brooklyn, 1921	128	14	10.9	88	43	48.8
	Brooklyn, 1922	134	1	.7	83	35	42.1
Monarch, S. N. 215, C. I. 1682.	Aberdeen, 1920	95	10	10.5			
	Brooklyn, 1921	101	0	0	78	0	0
	Brooklyn, 1922	58	0	0	93	0	0
Monarch Selection (of Etheridge), S. N. 162, C. I. 1879.	Columbia ①	22	12	54.5	26	0	0
	Aberdeen, 1920	62	25	40.3			
	Brooklyn, 1921	105	68	64.7	82	5	6.0
Montana, S. N. 10, C. I. 1761.	Columbia ④	339	13	3.8	335	23	6.8
	Ames, 1919	106	0	0	149	8	5.3
	Ames, 1920	85	7	8.2	60	8	13.3
	Aberdeen, 1920	61	20	32.7	137	56	40.8
	Manhattan, 1920	51	14	27.4	48	10	20.8
	Brooklyn, 1921	132	97	73.4	103	46	44.6
Var. mutica, S. N. 11 [d]	Columbia ② ①	198	27	13.6	80	0	0
	Aberdeen, 1920	37	5	13.5			
Var. mutica, S. N. 42	Columbia ③ ④	207	69	33.3	277	29	10.4
	Ames, 1919	82	2	2.4	95	2	2.1
	Aberdeen, 1920	158	46	29.1	117	16	13.6
	Manhattan, 1920	22	3	13.6	28	1	3.5
Var. mutica, S. N. 43	Columbia ④ ③	464	101	21.7	240	34	14.1
	Columbia, 1920	75	3	4.0	112	22	19.6
	Ames, 1919	104	3	2.8	61	3	4.9
	Ames, 1920	81	12	14.8	99	21	21.2
	Aberdeen, 1919	60	3	5.0	113	23	20.3
	Aberdeen, 1920	107	19	17.1	120	34	28.3
	Manhattan, 1920	68	18	26.4	57	10	17.5
	Pullman, 1920				80	51	63.8
Var. mutica, S. N. 44	Aberdeen, 1920	14	4	28.5			
Var. mutica, S. N. 45	Columbia ④ ③	387	7	1.8	231	2	.8
	Aberdeen, 1920	8	0	0			
Var. mutica, S. N. 46	Columbia ②	134	27	20.1	132	2	1.5
	Aberdeen, 1920	17	6	35.2			
Var. mutica, S. N. 47	Columbia ②	166	61	36.7	157	27	17.1
	Aberdeen, 1920	65	22	33.8			
Var. mutica, S. N. 48	Columbia ③	303	81	26.7	237	44	18.5
	Aberdeen, 1920	6	1	16.6			
Var. mutica, S. N. 49	Columbia ②	95	22	23.1	85	20	23.5
	Ames, 1919	46	1	2.1	33	1	3.0
	Aberdeen, 1920	87	28	32.1			
Var. mutica, S. N. 50	Columbia ①	117	27	23.0	91	11	12.0
	Aberdeen, 1920	6	0	0			
Var. mutica, S. N. 51	Columbia ③	275	50	18.1	225	42	18.6
	Ames, 1919	102	6	5.8	60	4	6.6
	Aberdeen, 1920	18	1	5.5			

[d] Nos. 11 and 42 to 58, inclusive, were received from Doctor Bubák; they represent types from separate localities and differ greatly in appearance.

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa—Continued.	Columbia ③	228	62	27.1	196	26	13.2
Var. mutica, S. N. 52	Ames, 1919	71	8	11.2	73	5	6.8
	Aberdeen, 1920	141	16	11.3	106	9	8.4
	Manhattan, 1920	40	11	27.5	29	1	3.4
	Columbia ②	109	46	42.2	114	26	22.8
Var. mutica, S. N. 53	Ames, 1919	46	9	19.5	48	12	25.0
	Aberdeen, 1920	161	41	25.4	117	51	43.5
	Manhattan, 1920	29	6	20.7	35	9	25.7
Var. mutica, S. N. 54	Columbia ②③	220	63	28.6	78	28	35.8
	Aberdeen, 1920	7	5	71.4			
Var. mutica, S. N. 55	Columbia ②	88	24	27.2	84	19	22.6
	Aberdeen, 1920	33	13	39.3			
Var. mutica, S. N. 56	Columbia ① ②	109	37	33.0	103	33	32.0
	Aberdeen, 1920	12	5	41.6			
Var. mutica, S. N. 57	Columbia ②	171	20	11.6	126	12	9.5
	Aberdeen, 1920	23	8	34.7			
Var. mutica, S. N. 58	Columbia ②	157	25	15.9	146	49	33.5
	Aberdeen, 1920	29	9	31.0			
Var. mutica, S. N. 286, C. I. 1675.	Columbia, 1920	56	2	3.5	66	3	4.5
	Ames, 1920	94	17	18.0	92	9	9.7
	Aberdeen, 1919	43	5	11.6	56	10	17.8
	Aberdeen, 1920	404	70	17.3	204	25	12.2
	Manhattan, 1920	84	19	22.6	107	17	15.8
	Brooklyn, 1921	210	74	35.2	151	44	29.1
Var. mutica, S. N. 331, C. I. 1716.	Columbia, 1920	66	3	4.5	75	0	0
	Ames, 1920	96	2	2.0	91	1	1.0
	Aberdeen, 1919	75	5	6.6	94	5	5.3
	Aberdeen, 1920	206	14	6.7	305	8	2.6
	Manhattan, 1920	53	8	15.0	96	5	5.2
	Pullman, 1920				129	6	4.7
	Brooklyn, 1921	198	56	28.2	174	8	4.5
Nebraska No. 21, S. N. 280, C. I. 841.	Columbia, 1920	50	0	0	100	0	0
	Ames, 1919	225	7	3.1	178	3	1.6
	Ames, 1920	112	10	8.9	112	1	.8
	Aberdeen, 1919	171	19	11.1	93	2	2.1
	Aberdeen, 1920	248	24	9.6	180	0	0
	Manhattan, 1920	105	8	7.6	137	4	2.9
	Pullman, 1920				79	0	0
Var. nigra, S. N. 12	Brooklyn, 1921	236	26	11.0	189	0	0
	Brooklyn, 1922	88	0	0	91	0	0
	Columbia ③	159	32	20.1	235	7	2.9
	Ames, 1919	59	6	10.1	73	3	4.1
	Aberdeen, 1920	33	0	0			
Var. nigra, S. N. 59	Brooklyn, 1921	171	1	.5	167	0	0
	Brooklyn, 1922	66	0	0	84	0	0
	Columbia ② ③	175	14	8.0	141	0	0
	Aberdeen, 1920	15	5	33.3			
Var. nigra, S. N. 60	Columbia ①	68	6	8.8			
	Aberdeen, 1920	30	4	13.3			
	Brooklyn, 1921	97	45	46.3	76	33	43.4
North Finnish, S. N. 123, C. I. 1882.	Columbia ②	204	48	23.5	152	47	30.9
	Columbia, 1920	55	0	0	99	13	13.1
	Ames, 1919	121	26	21.4	121	23	19.0
	Ames, 1920	98	4	4.0	86	17	19.7
	Aberdeen, 1919	85	16	18.8	123	31	25.2
	Aberdeen, 1920	307	57	18.5	166	13	7.8
	Manhattan, 1920	46	12	26.0	45	5	11.1
	Pullman, 1920				98	22	22.4
North Finnish, S. N. 184, C. I. 1758.	Brooklyn, 1921	102	14	13.7	93	15	16.1
	Aberdeen, 1920	81	14	17.2			
North Finnish, S. N. 216, C. I. 1764.	Brooklyn, 1921	108	35	32.4	60	16	26.6
	Aberdeen, 1920	96	43	44.7			
	Brooklyn, 1921	99	62	62.6	74	60	81.0
Old Island Black, S. N. 163.	Columbia ①	56	5	8.9	69	17	24.0
	Aberdeen, 1920	71	13	18.3			
Old Island Black, S. N. 217, C. I. 1756.	Brooklyn, 1921	130	49	37.6	95	24	25.2
	Aberdeen, 1920	43	12	27.9			
	Brooklyn, 1921	105	58	55.2	93	35	37.6

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa—Continued.							
Var. praegravis, S. N. 13 [e]	Columbia ①	77	36	46.7	71	36	50.7
	Columbia ②	132	36	27.2	137	39	28.4
	Columbia, 1920	44	3	6.8	85	12	14.1
	Ames, 1920	89	26	29.2	115	6	5.1
Var. praegravis, S. N. 61, C. I. 1774.	Aberdeen, 1919	139	31	22.3	114	38	33.3
	Aberdeen, 1920	391	80	20.4	165	60	36.3
	Manhattan, 1920	37	16	43.2	55	10	18.1
	Pullman, 1920				106	61	57.5
	Brooklyn, 1921	103	49	47.5	67	33	49.2
	Columbia ② ③	143	37	25.8	244	43	17.6
Var. praegravis, S. N. 62	Ames, 1919	71	39	54.9	96	11	11.4
	Aberdeen, 1920	148	69	46.6	148	81	54.7
	Columbia, 1920	45	1	2.2	110	6	5.4
	Ames, 1920	78	11	14.1	85	26	30.5
Var. praegravis, S. N. 63, C. I. 1775.	Aberdeen, 1919	110	28	25.4	65	16	24.6
	Aberdeen, 1920	224	11	4.9	207	12	5.7
	Manhattan, 1920	91	21	23.0	96	2	2.0
	Pullman, 1920				111	6	5.4
	Brooklyn, 1921	100	18	18.0	68	3	4.4
	Aberdeen, 1920	98	2	2.0			
Pringle Progress, S. N. 218, C. I. 1717.	Brooklyn, 1921	208	7	3.3	141	3	2.1
	Brooklyn, 1922	101	0	0	124	3	2.4
Probsteier, S. N. 219, C. I. 1655.	Aberdeen, 1920	78	40	51.2			
	Brooklyn, 1921	89	69	77.5	63	39	61.9
	Columbia, 1920	43	1	2.3	90	0	0
	Ames, 1919	180	5	2.7	182	7	3.8
	Ames, 1920	118	2	1.6	188	8	4.2
Richland, S. N. 281, C. I. 787.	Aberdeen, 1919	106	10	9.4	142	10	7.0
	Aberdeen, 1920	373	13	3.4	313	21	6.7
	Manhattan, 1920	282	21	7.4	244	25	10.2
	Pullman, 1920				121	10	8.3
	Brooklyn, 1921	272	35	12.8	198	14	7.0
	Columbia, 1920	50	2	4.0	70	1	1.4
	Ames, 1920	102	15	14.7	84	1	1.1
	Aberdeen, 1919	117	34	29.0	123	4	3.2
Rossman, S. N. 322, C. I. 1688 (closely resembles Irish Victor).	Aberdeen, 1920	238	63	26.4	133	1	.7
	Manhattan, 1920	84	27	32.1	71	1	1.4
	Pullman, 1920				74	1	1.4
	Brooklyn, 1921	203	90	44.3	135	0	0
	Brooklyn, 1922	59	1	1.6	85	0	0
	Columbia, 1920	13	0	0	7	0	0
Ruakura Rustproof, S. N. 266, C. I. 701.	Ames, 1920	47	6	12.7	46	10	21.7
	Aberdeen, 1920	47	14	29.7			
	Brooklyn, 1921	114	45	39.4	71	12	16.9
	Columbia ②	124	19	15.3	106	6	5.6
	Columbia, 1920	70	1	1.4	70	0	0
	Ames, 1919	78	4	5.1	96	1	1.0
	Ames, 1920	109	2	1.8	82	3	3.6
Scottish Chief, S. N. 124, C. I. 1901.	Aberdeen, 1919	66	8	12.1	36	0	0
	Aberdeen, 1920	178	9	5.0	112	0	0
	Manhattan, 1920	86	24	27.9	46	0	0
	Pullman, 1920				111	1	.9
	Brooklyn, 1921	204	17	8.3	153	0	0
	Brooklyn, 1922	78	0	0	75	0	0
	Columbia ③ ④	242	32	13.2	324	32	9.8
Var. setosa, S. N. 14	Aberdeen, 1920	17	0	0	47	0	0
	Brooklyn, 1921	92	1	1.0	62	0	0
	Brooklyn, 1922	72	0	0	68	0	0
	Columbia, 1920	60	2	3.3	89	16	17.9
	Ames, 1919	126	15	11.9	109	21	19.2
	Ames, 1920	94	13	13.8	88	12	13.6
Siberian, S. N. 282, C. I. 741 (closely resembles Lincoln).	Aberdeen, 1919	108	14	12.9	117	26	22.2
	Aberdeen, 1920	195	71	36.4	113	52	46.0
	Manhattan, 1920	55	20	36.3	61	16	26.2
	Pullman, 1920				74	36	48.6
	Brooklyn, 1921	119	34	28.5	83	18	21.6

[e] Nos. 13, 61, 62, and 63, received from Doctor Bubák, represent types from different localities.

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa—Continued.							
Siberian, S. N. 323, C. I. 1712.	Columbia, 1920	50	0	0	75	0	0
	Ames, 1920	105	0	0	90	0	0
	Aberdeen, 1919	31	0	0	46	0	0
	Aberdeen, 1920	93	0	0	151	0	0
	Manhattan, 1920	90	0	0	186	0	0
	Pullman, 1920				65	0	0
	Brooklyn, 1921	371	0	0	275	1	.3
	Brooklyn, 1922	91	0	0	42	0	0
Silvermine, S. N. 164	Columbia ①	36	6	16.6	31	11	35.4
	Aberdeen, 1920	58	16	27.5			
	Brooklyn, 1921	93	34	36.5	70	16	22.8
Silvermine (Early Dakota), S. N. 199, C. I. 1697.	Aberdeen, 1920	100	31	31.0			
Silvermine, S. N. 220, C. I. 659.	Ames, 1919	148	30	20.2	204	15	7.3
	Aberdeen, 1920	108	34	31.4	102	43	42.1
	Manhattan, 1920	83	22	26.5	71	3	4.2
	Brooklyn, 1921	124	45	36.2	66	8	12.1
Silvermine, S. N. 221, C. I. 1727.	Aberdeen, 1920	55	15	27.2			
	Brooklyn, 1921	102	36	35.2	65	19	29.2
Silvermine (American Banner), S. N. 222, C. I. 1729.	Aberdeen, 1920	63	21	33.3			
	Brooklyn, 1921	108	49	45.3	79	34	43.0
Silvermine (Abyssinian), S. N. 303, C. I. 1747.	Columbia, 1920	73	1	1.3	52	6	11.5
	Ames, 1920	113	5	4.4	91	12	13.1
	Aberdeen, 1919	78	5	6.4	108	9	8.3
	Aberdeen, 1920	136	8	5.8	140	2	1.4
	Manhattan, 1920	77	11	14.2	100	12	12.0
	Pullman, 1920				65	11	16.9
	Brooklyn, 1921	89	17	19.1	60	19	31.6
Silvermine (President), S. N. 319, C. I. 1629.	Columbia, 1920	24	3	12.5	63	4	6.3
	Ames, 1920	105	15	14.2	84	14	16.6
	Aberdeen, 1919	76	12	15.7	68	6	8.8
	Aberdeen, 1920	168	22	13.0	231	45	19.4
	Manhattan, 1920	83	13	15.6	85	11	12.9
	Pullman, 1920				89	29	32.6
	Brooklyn, 1921	91	42	46.1	79	27	34.1
Silvermine Selection (of Etheridge), S. N. 165, C. I. 1894.	Columbia ①	41	9	21.9	59	21	35.5
	Aberdeen, 1920	73	27	36.9			
	Brooklyn, 1921	102	51	50.0	78	37	47.4
Silvermine Selection (Swedish Select), S. N. 231, C. I. 1634.	Ames, 1919	131	40	30.5	119	16	13.4
	Aberdeen, 1920	189	81	42.8	79	43	54.4
	Manhattan, 1920	86	44	51.1	45	15	33.3
	Brooklyn, 1921	99	21	21.2	74	21	28.3
	Brooklyn, 1922	127	5	3.9	144	14	9.7
Sixty-Day, S. N. 166	Columbia ①	59	21	35.5	46	25	54.3
	Aberdeen, 1920	101	49	48.5			
	Brooklyn, 1921	130	60	46.1	86	15	17.4
Sixty-Day, S. N. 223, C. I. 165.	Columbia, 1920	158	15	9.5	332	32	9.6
	Ames, 1919	242	28	11.5	132	0	0
	Ames, 1920	644	60	9.3	508	58	11.4
	Aberdeen, 1919	256	36	14.0	277	35	12.6
	Aberdeen, 1920	188	58	30.8	134	34	25.3
	Manhattan, 1920	577	152	26.3	545	79	14.4
	Pullman, 1920				131	49	37.4
	Brooklyn, 1921	127	12	9.4	77	9	11.6
Sixty-Day, S. N. 224, C. I. 1619.	Aberdeen, 1920	95	31	32.6			
	Brooklyn, 1921	126	53	42.0	109	28	25.6
Sixty-Day Selection (of Etheridge), S. N. 167, C. I. 1906.	Columbia ①	60	5	8.3	47	14	29.7
	Aberdeen, 1920	85	10	11.7			
	Brooklyn, 1921	109	20	18.3	105	13	12.3
Swedish Select, S. N. 168.	Columbia ①	27	8	29.6	31	14	45.1
	Aberdeen, 1920	39	11	28.2			
	Brooklyn, 1921	88	31	35.2	78	22	28.2
	Brooklyn, 1922	107	13	12.1	162	17	10.5
Swedish Select, S. N. 225, C. I. 1627.	Aberdeen, 1920	54	9	16.6			
	Brooklyn, 1921	75	32	42.6	82	22	26.8

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa—Continued.							
Swedish Select, S. N. 226, C. I. 134.	Columbia, 1920	22	4	18.1	74	15	20.2
	Ames, 1919	148	52	35.1	146	16	10.9
	Ames, 1920	118	12	10.1	92	21	22.8
	Aberdeen, 1919	134	14	10.4	102	16	15.6
	Aberdeen, 1920	115	8	6.9	136	44	32.3
	Manhattan, 1920	69	25	36.2	48	10	20.8
	Pullman, 1920				68	27	39.7
	Brooklyn, 1921	92	26	28.2	57	6	10.5
	Brooklyn, 1922	176	2	1.1	116	4	3.4
Swedish Select (Ligowa), S. N. 227, C. I. 1740.	Ames, 1919	104	25	24.0	144	16	11.1
	Aberdeen, 1920	187	46	24.6			
	Brooklyn, 1921	105	34	32.3	67	27	40.2
	Brooklyn, 1922	174	2	1.1	161	22	13.6
Swedish Select, S. N. 228, C. I. 552.	Ames, 1919	85	24	28.2	115	9	7.8
	Aberdeen, 1920	212	52	24.5	107	29	27.1
	Manhattan, 1920	66	20	30.3	74	9	12.1
	Brooklyn, 1921	109	36	33.0	69	19	27.5
	Brooklyn, 1922	135	11	8.1	155	16	10.3
Swedish Select, S. N. 229, C. I. 1743 (closely resembles Gothland).	Aberdeen, 1920	138	19	13.7			
	Brooklyn, 1921	115	21	18.2	88	3	3.4
Tobolsk, S. N. 122, C. I. 1983.	Columbia ②	159	15	9.4	202	79	39.1
	Columbia, 1920	64	1	1.5	104	36	34.6
	Ames, 1919	114	17	14.9	153	9	5.8
	Ames, 1920	121	18	14.8	109	47	43.1
	Aberdeen, 1919	109	16	14.6	146	42	28.7
	Aberdeen, 1920	101	20	19.8	157	65	41.4
	Manhattan, 1920	43	15	34.8	62	13	20.9
	Pullman, 1920				135	67	49.6
	Brooklyn, 1921	112	19	16.9	83	21	25.3
Tobolsk, S. N. 232, C. I. 1709.	Ames, 1919	103	30	29.0	172	22	12.8
	Aberdeen, 1920	121	27	22.3			
	Manhattan, 1920	39	14	35.9	32	6	18.7
	Brooklyn, 1921	137	28	19.9	105	43	40.9
Var. trisperma, S. N. 64.	Columbia ③ ④	166	18	10.8	293	23	7.8
	Columbia, 1920	33	4	12.1	60	1	1.6
	Ames, 1920	75	12	16.0	74	3	4.0
	Aberdeen, 1919	57	11	19.3	62	0	0
	Aberdeen, 1920	242	42	17.3	113	0	0
	Manhattan, 1920	43	7	16.2	40	2	5.0
	Pullman, 1920				63	2	3.2
	Brooklyn, 1921	227	72	31.7	149	6	4.0
	Brooklyn, 1922	176	6	3.3	212	0	0
Victor, S. N. 126.	Columbia ③⑤	247	76	30.7	90	30	33.3
	Columbia, 1920	65	4	6.1	103	44	42.7
	Ames, 1920	77	26	33.7	73	39	53.4
	Aberdeen, 1919	65	32	49.0	116	58	50.0
	Aberdeen, 1920	50	30	60.0	143	82	57.3
	Manhattan, 1920	42	17	40.4	41	8	19.5
	Pullman, 1920				107	72	67.3
	Brooklyn, 1921	611	377	61.7	602	415	68.9
	Brooklyn, 1922	374	77	20.5	443	177	39.9
Victor, S. N. 233, C. I. 1755.	Columbia, 1920	43	7	16.2	62	21	33.8
	Ames, 1919	18	4	22.2	149	30	20.1
	Ames, 1920	70	25	35.7	86	27	31.3
	Aberdeen, 1919	109	45	41.2	91	46	50.5
	Aberdeen, 1920	225	132	58.6	146	100	68.4
	Manhattan, 1920	218	99	45.4	181	25	13.8
	Pullman, 1920				87	59	67.8
	Brooklyn, 1921	184	130	70.6	165	117	70.9
	Brooklyn, 1922	88	19	21.5	84	43	51.1
Victory, S. N. 283, C. I. 560.	Ames, 1919	250	30	12.0	266	74	27.8
	Ames, 1920	106	10	9.4	85	27	31.7
	Aberdeen, 1920	127	51	40.1	139	77	55.3
	Manhattan, 1920	54	19	35.1	36	9	25.0
	Brooklyn, 1921	104	32	30.7	69	13	18.8
Victory, S. N. 364	Aberdeen, 1920	93	29	31.1	85	30	35.2
	Brooklyn, 1921	102	39	38.2	83	18	21.6

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa—Continued. Wernich Golden, S. N. 324, C. I. 1672.	Columbia, 1920	41	3	7.3	39	5	13.0
	Ames, 1920	88	23	26.1	85	16	18.8
	Aberdeen, 1919	120	38	31.6	90	39	43.3
	Aberdeen, 1920	55	25	45.4	65	29	44.6
	Manhattan, 1920	52	20	38.4	42	8	19.0
	Pullman, 1920				47	20	42.6
White Bonanza, S. N. 325, C. I. 1650.	Brooklyn, 1921	90	34	37.7	70	19	27.1
	Columbia, 1920	43	5	11.6	89	18	20.2
	Ames, 1919	108	15	13.8	106	24	22.6
	Aberdeen, 1919	66	21	31.8	117	14	11.9
	Aberdeen, 1920	183	60	32.7	150	43	28.6
	Manhattan, 1920	104	56	53.8	60	15	25.0
	Pullman, 1920				115	54	47.0
White Maine, S. N. 234, C. I. 1752.	Brooklyn, 1921	101	36	35.6	64	35	54.6
	Aberdeen, 1920	107	52	48.5			
White Maine, S. N. 326, C. I. 1651.	Brooklyn, 1921	137	19	13.8	56	3	5.3
	Columbia, 1920	50	0	0	95	5	5.2
	Ames, 1920	89	11	12.3	128	12	9.3
	Aberdeen, 1919	98	7	7.1	95	15	15.7
	Aberdeen, 1920	146	20	13.6	202	22	10.8
	Manhattan, 1920	125	33	26.4	72	12	16.6
	Pullman, 1920				137	6	4.4
White Queen, S. N. 327, C. I. 1700.	Brooklyn, 1921	125	7	5.6	62	11	17.7
	Columbia, 1920	74	4	5.4	65	0	0
	Ames, 1920	88	10	11.3	99	0	0
	Aberdeen, 1919	78	17	21.7	106	1	.9
	Aberdeen, 1920	129	6	4.6	189	0	0
	Manhattan, 1920	100	15	15.0	93	10	10.7
	Pullman, 1920				120	2	1.7
Winter Turf, S. N. 169	Brooklyn, 1921	105	8	7.6	61	0	0
	Brooklyn, 1922	76	2	2.6	99	0	0
	Ames, 1919	42	14	33.3	52	0	0
	Aberdeen, 1920	86	38	44.1			
Winter Turf, S. N. 237, C. I. 673.	Ames, 1919	49	4	8.1	115	3	2.6
	Ames, 1920	80	4	5.0	87	6	6.8
	Aberdeen, 1919	106	12	11.3	63	4	6.3
	Aberdeen, 1920	46	10	21.7	52	0	0
	Pullman, 1920				79	22	27.8
Winter Turf, S. N. 347, C. I. 431.	Aberdeen, 1920	111	32	28.8	64	36	56.2
	Manhattan, 1920	104	33	31.7	67	6	8.9
	Pullman, 1920				101	8	7.9
Winter Turf (selection), S. N. 235, C. I. 195–15.	Aberdeen, 1920	122	39	31.9			
Winter Turf (selection), S. N. 236, C. I. 274–20.	Ames, 1919	78	0	0	134	1	.7
	Aberdeen, 1920	182	55	30.2	50	22	44.0
	Manhattan, 1920	75	21	28.0	41	0	0
	Pullman, 1920				118	5	4.2
Winter Turf (selection), S. N. 258, C. I. 388–6.	Ames, 1919	136	27	19.8	178	4	2.2
	Aberdeen, 1920	191	53	27.7	40	2	5.0
	Brooklyn, 1921	157	60	38.7	114	39	34.2
Winter Turf (selection), S. N. 348, C. I. 195–10.	Aberdeen, 1920	103	21	20.3	70	36	51.4
	Manhattan, 1920	99	12	12.1	44	2	4.5
	Pullman, 1920				114	10	8.8
Winter Turf (selection), S. N. 350, C. I. 409–5.	Aberdeen, 1920	134	59	44.0	92	55	59.7
	Manhattan, 1920	106	18	17.0	39	0	0
	Pullman, 1920				112	36	32.1
Winter Turf (selection), S. N. 351, C. I. 435–4.	Aberdeen, 1920	144	64	44.4	83	59	71.0
	Manhattan, 1920	64	12	18.7	30	0	0
	Pullman, 1920				103	18	17.5
Winter Turf (selection), S. N. 352, C. I. 541–4.	Aberdeen, 1920	128	57	44.5	97	67	69.0
	Manhattan, 1920	96	26	27.0	23	0	0
	Pullman, 1920				112	20	17.9
Wisconsin Pedigree, S. N. 365.	Aberdeen, 1920	79	23	29.1	124	66	53.2
	Brooklyn, 1921	119	28	23.5	64	22	34.3
Wisconsin No. 1, S. N. 366.	Ames, 1920	82	15	18.2	88	33	37.5
	Aberdeen, 1920	131	53	40.4	118	74	62.7
	Manhattan, 1920	60	26	43.3	36	4	11.1
	Pullman, 1920				79	48	60.8
	Brooklyn, 1921	139	32	23.0	60	23	38.3

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa orientalis:							
Black Rival (Garton Black), S. N. 240, C. I. 1617.	Aberdeen, 1920	58	22	37.9			
Black Tartar, S. N. 108	Columbia ②	155	17	10.9	141	45	31.9
	Aberdeen, 1920	54	22	40.7			
	Pullman, 1920				58	32	55.2
	Brooklyn, 1921	115	67	58.2	95	46	48.4
	Brooklyn, 1922	111	15	13.5	162	62	38.2
Black Tartar, S. N. 239, C. I. 1595.	Aberdeen, 1920	84	20	23.8			
	Brooklyn, 1921	111	64	57.6	103	56	54.3
Flava, S. N. 31	Columbia ③ ②	202	33	16.3	140	26	18.5
	Aberdeen, 1920	61	20	32.7			
	Brooklyn, 1921	99	46	46.4	92	69	75.0
Garton 473, S. N. 297, C. I. 1613.	Columbia, 1920	47	12	25.5	35	0	0
	Ames, 1920	77	15	19.4	36	9	25.0
	Aberdeen, 1919	72	6	8.3	74	11	14.8
	Aberdeen, 1920	68	19	27.9	88	39	44.3
	Manhattan, 1920	33	9	27.2	32	3	9.3
	Pullman, 1920				86	52	60.5
Garton 585, S. N. 170, C. I. 1868.	Brooklyn, 1921	89	35	39.3	63	15	23.8
	Columbia ①	18	2	11.1	18	8	44.4
	Aberdeen, 1920	30	9	30.0			
	Brooklyn, 1921	73	27	36.9	51	25	49.0
Garton 748, S. N. 109, C I. 1862.	Columbia ②	179	47	26.2	160	58	36.2
	Columbia, 1920	91	9	9.8	92	38	41.3
	Ames, 1919	248	45	18.1	326	21	6.4
	Ames, 1920	87	20	23.0	73	24	32.8
	Aberdeen, 1919	109	38	34.8	143	64	44.7
	Aberdeen, 1920	119	68	57.1	189	117	61.9
	Manhattan, 1920	64	20	31.2	46	7	15.2
	Pullman, 1920				201	106	52.7
Garton 748, S. N. 242, C. I. 1612.	Brooklyn, 1921	106	27	25.4	74	22	29.7
	Columbia, 1920	62	7	11.2	57	8	14.0
	Ames, 1920	105	37	35.2	135	33	24.4
	Aberdeen, 1919	80	23	28.7	144	57	39.5
	Aberdeen, 1920	273	100	36.6	232	85	36.6
	Manhattan, 1920	50	6	12.0	58	13	22.4
	Pullman, 1920				98	38	38.8
Garton 784, S. N. 171	Brooklyn, 1921	116	27	23.2	95	19	20.0
	Columbia ①	21	7	33.3	18	4	22.2
	Aberdeen, 1920	48	20	41.6			
Garton Gray, S. N. 172	Columbia ①	29	11	37.9	20	14	70.0
	Ames, 1919	45	12	26.6	50	13	26.0
	Aberdeen, 1920	39	17	43.5			
	Manhattan, 1920	31	9	29.0	31	8	25.8
	Brooklyn, 1921	101	29	28.7	62	29	46.7
Garton Gray, S. N. 241, C. I. 1610.	Aberdeen, 1920	98	29	29.5			
	Brooklyn, 1921	79	21	26.3	91	34	37.3
Golden Giant, S. N. 173	Columbia ①	50	8	16.0	46	21	45.6
	Ames, 1919	94	17	18.0	124	10	8.0
	Aberdeen, 1920	135	49	36.3	105	47	44.7
	Manhattan, 1920	10	1	10.0	22	7	31.8
	Brooklyn, 1921	108	30	27.7	98	46	46.9
Golden Giant, S. N. 243, C. I. 1606.	Aberdeen, 1920	74	22	29.7			
	Brooklyn, 1921	98	27	27.5	79	34	43.0
Golden Giant, S. N. 244, C. I. 1607.	Aberdeen, 1920	122	32	26.2			
	Brooklyn, 1921	85	33	38.8	76	26	34.2
Green Mountain, S. N. 110, C. I. 1872.	Columbia ②	136	58	42.6	131	51	38.9
	Columbia, 1920	81	11	13.7	83	36	43.3
	Ames, 1919	188	74	39.3	149	58	38.9
	Ames, 1920	79	21	26.5	83	50	60.2
	Aberdeen, 1919	85	23	27.0	84	42	50.0
	Aberdeen, 1920	129	53	41.0	182	104	57.1
	Manhattan, 1920	31	8	25.8	39	12	30.7
	Pullman, 1920				189	133	70.4
	Brooklyn, 1921	100	36	36.0	67	23	34.3

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa orientalis—Con.	Columbia ⑧	243	55	22.6	245	35	14.2
Var. mutica, S. N. 32	Ames, 1919	80	9	11.2	114	4	3.5
	Aberdeen, 1920	137	41	29.0	106	10	9.4
	Brooklyn, 1921	88	32	36.0	64	5	7.8
Var. nigra, S. N. 245, C. I. 1598.	Aberdeen, 1920	84	32	38.0			
	Brooklyn, 1921	78	38	48.6	78	37	47.4
Var. obtusata, S. N. 4	Columbia ①	34	18	52.9			
	Aberdeen, 1920	4	2	50.0			
	Columbia ④	397	40	10.0	359	37	10.3
	Ames, 1919	85	7	8.2	97	1	1.0
Var. obtusata, S. N. 33	Aberdeen, 1920	135	19	14.0	102	13	12.7
	Manhattan, 1920	49	12	24.4	35	6	17.1
	Brooklyn, 1921	205	47	22.9	176	24	13.6
Var. pugnax, S. N. 65	Columbia ⑤ ⑤	336	77	22.9	184	35	19.0
	Aberdeen, 1920	12	2	16.6			
	Brooklyn, 1921	101	65	64.3	86	48	55.8
Seizure, S. N. 247, C. I. 1604.	Aberdeen, 1920	102	29	28.4			
	Brooklyn, 1921	91	40	43.9	87	23	26.4
Var. setosa, S. N. 302, C. I. 1618.	Columbia, 1920	22	3	13.6	82	6	7.3
	Ames, 1920	111	21	18.9	104	28	26.9
	Aberdeen, 1919	68	22	32.3	82	17	20.7
	Aberdeen, 1920	154	59	38.3	131	83	63.3
	Manhattan, 1920	26	7	27.0	28	5	17.8
	Pullman, 1920				121	73	60.3
Sparrowbill, S. N. 111, C. I. 1867.	Brooklyn, 1921	86	35	40.6	86	23	26.7
	Columbia ②	138	25	18.1	168	40	23.8
	Columbia, 1920	90	7	7.7	97	38	39.0
	Ames, 1919	146	16	10.9	140	19	13.5
	Ames, 1920	63	21	33.3	84	32	38.0
	Aberdeen, 1919	82	11	13.4	49	9	18.3
	Aberdeen, 1920	115	43	37.3	157	37	23.5
	Manhattan, 1920	48	5	10.4	31	9	29.0
	Pullman, 1920				102	56	54.9
Sparrowbill (Eclipse), S. N. 274, C. I. 843.	Brooklyn, 1921	91	59	64.8	99	32	32.3
	Columbia, 1920	78	3	3.8	175	17	9.7
	Ames, 1919	176	0	0	138	1	.7
	Ames, 1920	179	35	19.5	159	23	14.4
	Aberdeen, 1919	203	10	4.9	247	26	10.5
	Aberdeen, 1920	214	35	16.3	232	53	22.8
	Manhattan, 1920	71	13	18.3	51	2	3.9
	Pullman, 1920				154	38	24.6
Storm King, S. N. 112	Brooklyn, 1921	112	10	8.9	81	10	12.3
	Brooklyn, 1922	66	1	1.5	105	18	17.1
	Columbia ②	120	2	1.6	119	11	9.2
	Columbia, 1920	91	4	4.3	64	39	60.7
	Ames, 1920	42	16	38.0	58	30	51.6
	Aberdeen, 1919	42	5	11.9	42	4	9.5
	Aberdeen, 1920	90	26	28.8	101	21	20.7
	Manhattan, 1920	47	20	42.5	56	14	25.0
	Pullman, 1920				119	44	37.0
Storm King (Senator), S. N. 248, C. I. 1603.	Brooklyn, 1921	58	25	43.1	49	10	20.4
	Aberdeen, 1920	64	22	34.3			
Storm King (Stout), S. N. 363.	Brooklyn, 1921	83	44	53.0	75	11	14.6
	Aberdeen, 1920	114	21	18.4	45	20	44.4
	Brooklyn, 1921	76	49	64.4	53	15	28.3
Tartar King, S. N. 113	Columbia ②	125	17	13.6	140	28	20.0
	Columbia, 1920	112	3	2.6	94	47	50.0
	Ames, 1919	207	45	21.7	205	36	17.5
	Ames, 1920	64	16	25.0	60	24	40.0
	Aberdeen, 1919	113	26	23.0	83	28	33.7
	Aberdeen, 1920	99	34	34.3	141	30	21.2
	Manhattan, 1920	49	11	22.4	12	3	25.0
	Pullman, 1920				109	42	38.5
Tartar King (Canada Cluster), S. N. 249, C. I. 1600.	Brooklyn, 1921	103	50	48.5	98	26	26.5
	Aberdeen, 1920	63	23	36.5			
	Brooklyn, 1921	86	45	52.3	77	22	28.5
Var. tartarica, S. N. 5	Columbia ③	222	38	17.1	344	34	9.8
	Aberdeen, 1920	49	2	4.0			
	Brooklyn, 1921	87	22	25.2	76	6	7.8

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sativa orientalis—Con.	Columbia ①	133	23	17.3	171	35	20.4
Var. tartarica, S. N. 34	Aberdeen, 1920	61	29	47.5			
	Brooklyn, 1921	86	61	70.9	80	40	50.0
Var. tartarica, S. N. 250, C. I. 1597.	Aberdeen, 1920	72	33	45.8			
	Brooklyn, 1921	77	47	61.0	89	38	42.6
Var. tristis, S. N. 40	Columbia ④	269	32	11.8	340	68	20.0
	Aberdeen, 1920	20	5	25.0			
	Brooklyn, 1921	98	73	74.4	99	37	37.3
	Columbia, 1920	42	9	21.4	72	5	6.9
	Ames, 1920	107	42	39.2	106	29	27.3
White Egyptian, S. N. 300, C. I. 1605.	Aberdeen, 1919	114	38	33.3	142	46	32.3
	Aberdeen, 1920	137	34	24.8	148	86	58.1
	Manhattan, 1920	30	8	26.6	62	23	37.0
	Pullman, 1920				99	70	70.7
	Brooklyn, 1921	122	49	40.1	112	23	20.5
	Columbia, 1920	64	3	4.6	132	6	4.5
	Ames, 1919	176	18	10.2	338	22	6.5
	Ames, 1920	104	17	16.3	103	18	17.4
White Tartar (White Russian), S. N. 284, C. I. 551.	Aberdeen, 1919	114	26	22.8	125	8	6.4
	Aberdeen, 1920	59	26	44.0	196	8	4.0
	Manhattan, 1920	65	14	21.5	36	11	30.5
	Pullman, 1920				94	17	18.1
	Brooklyn, 1921	103	30	29.1	66	3	4.5
	Columbia, 1920	54	7	12.9	75	5	6.6
	Ames, 1920	107	25	23.3	116	35	30.1
White Tartar (White Russian), S. N. 301, C. I. 1614.	Aberdeen, 1919	91	18	19.7	110	10	9.0
	Aberdeen, 1920	114	22	19.2	132	24	18.1
	Manhattan, 1920	27	6	22.2	49	6	12.2
	Pullman, 1920				85	9	10.6
	Brooklyn, 1921	95	37	38.9	92	4	4.3
	Columbia ①	38	13	34.2	41	4	9.7
	Columbia, 1920	48	1	2.0	94	12	12.7
	Ames, 1920	86	18	20.9	80	19	23.7
White Tartar, S. N. 174	Aberdeen, 1919	94	24	25.5	43	13	30.2
	Aberdeen, 1920	239	98	41.0	244	3	1.2
	Manhattan, 1920	52	26	50.0	48	4	8.3
	Pullman, 1920				96	23	24.0
	Brooklyn, 1921	77	41	53.2	75	12	16.0
White Tartar (Frankside), S. N. 251, C. I. 842.	Aberdeen, 1920	61	16	26.2			
	Brooklyn, 1921	78	38	48.7	69	31	44.9
	Columbia, 1920	50	4	8.0	74	5	6.9
	Ames, 1920	84	41	48.8	112	56	50.0
White Tartar, S. N. 299, C. I. 1615.	Aberdeen, 1919	99	49	49.4	96	56	58.3
	Aberdeen, 1920	134	72	53.7	81	60	74.0
	Manhattan, 1920	19	5	26.3	26	6	23.0
	Pullman, 1920				83	68	81.9
	Brooklyn, 1921	90	55	61.1	101	47	46.5
	Columbia, 1920	94	8	8.1	94	4	4.2
	Ames, 1920	113	19	16.8	113	18	15.9
	Aberdeen, 1919	183	71	38.8	188	77	40.9
S. N. 335 /	Aberdeen, 1920	180	101	56.1	240	97	40.4
	Manhattan, 1920	80	16	20.0	45	2	4.4
	Pullman, 1920				124	71	57.3
	Brooklyn, 1921	127	41	32.2	68	16	23.5
	Columbia, 1920	46	6	13.0	67	26	38.8
	Ames, 1920	81	17	20.9	101	51	50.4
	Aberdeen, 1919	101	60	59.4	76	5	6.5
S. N. 336	Aberdeen, 1920	147	78	53.0	91	70	76.9
	Manhattan, 1920	32	19	59.3	41	19	46.3
	Pullman, 1920				107	55	51.4
	Brooklyn, 1921	105	66	62.8	68	40	58.8
	Columbia, 1920	68	11	16.1	83	17	20.4
	Ames, 1920	136	18	13.2	109	23	21.1
	Aberdeen, 1919	160	57	35.6	162	60	37.0
S. N. 337	Aberdeen, 1920	147	37	25.1	93	43	46.2
	Manhattan, 1920	48	17	35.4	81	14	17.2
	Pullman, 1920				98	30	30.6
	Brooklyn, 1921	86	25	29.0	72	9	12.5

/ Nos. 335, 336, and 337 are large coarse German types received from Dr. W. C. Etheridge.

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sterilis:							
S. N. 27	Columbia ⑧	125	18	14.4	270	37	13.7
	Aberdeen, 1920	16	9	56.2			
S. N. 28	Columbia ④ ③	201	3	1.4	185	0	0
	Columbia, 1920	66	4	6.0	64	10	1.5
	Ames, 1919	245	39	15.9	181	7	3.8
	Ames, 1920	72	4	5.5	47	5	10.6
	Aberdeen, 1919	85	28	32.9	98	36	36.7
	Aberdeen, 1920	111	9	8.1	120	10	8.3
	Manhattan, 1920	43	4	9.3			
	Pullman, 1920				125	21	16.8
	Brooklyn, 1921	74	8	10.8	66	2	3.0
S. N. 128	Aberdeen, 1920	20	1	5.0			
	Brooklyn, 1921	49	1	2.0	38	0	0
S. N. 252, C. I. 1784 (Arlington selection).	Aberdeen, 1920	35	20	57.1			
Black Algerian, S. N. 261, C. I. 1785.	Aberdeen, 1920	85	0	0			
	Brooklyn, 1921	58	0	0	46	0	0
	Brooklyn, 1922	59	1	1.6	58	0	0
Burt, S. N. 67	Columbia ⑤ ④	881	13	1.4	542	3	.5
	Columbia, 1920	70	0	0	70	4	5.7
	Ames, 1919	196	2	1.0	297	2	.6
	Ames, 1920	62	1	1.6	69	0	0
	Aberdeen, 1919	240	12	5.0	258	6	2.3
	Aberdeen, 1920	155	0	0	111	0	0
	Manhattan, 1920	116	3	2.5	155	0	0
	Pullman, 1920				69	0	0
	Brooklyn, 1921	153	2	1.3	104	0	0
	Brooklyn, 1922	60	0	0	73	0	0
Burt (Early Ripe), S. N. 74.	Columbia ④ ⑧	680	151	22.2	311	22	7.0
	Columbia, 1920	62	4	6.4	106	13	12.2
	Ames, 1919	225	24	10.6	197	1	.5
	Ames, 1920	116	7	6.0	107	2	1.8
	Aberdeen, 1919	333	118	35.4	342	64	18.7
	Aberdeen, 1920	206	18	8.7	125	0	0
	Manhattan, 1920	187	22	11.7	153	6	3.9
	Pullman, 1920				119	0	0
	Brooklyn, 1921	67	9	13.4	70	0	0
	Brooklyn, 1922	89	0	0	104	2	1.9
Burt, S. N. 75	Columbia ⑤ ④	752	50	6.6	447	17	3.8
	Columbia, 1920	29	1	3.4	65	2	3.1
	Ames, 1919	153	8	5.2	193	0	0
	Ames, 1920	95	7	7.3	80	8	10.0
	Aberdeen, 1919	238	42	17.6	258	27	10.4
	Aberdeen, 1920	184	7	3.8	95	0	0
	Manhattan, 1920	109	12	11.0	148	4	2.7
	Pullman, 1920				84	5	5.9
	Brooklyn, 1921	68	0	0	57	1	1.7
	Brooklyn, 1922	70	0	0	68	3	4.4
Burt, S. N. 175	Columbia ①	31	0	0	36	0	0
	Columbia, 1920	166	1	.7	190	0	0
	Ames, 1920	495	0	0	418	2	.4
	Aberdeen, 1919	63	0	0	28	0	0
	Aberdeen, 1920	304	1	.3	170	5	2.9
	Manhattan, 1920	697	2	.2	650	0	0
	Pullman, 1920				186	0	0
	Brooklyn, 1921	492	5	1.0	407	1	.2
	Brooklyn, 1922	405	0	0	413	0	0
Burt, S. N. 253, C. I. 823.	Columbia ①	142	5	3.5	202	4	1.9
	Columbia, 1920	146	1	.6	135	0	0
	Ames, 1919	76	0	0	101	0	0
	Ames, 1920	622	2	.3	592	3	.5
	Aberdeen, 1919	328	0	0	298	2	.6
	Aberdeen, 1920	425	2	.4	423	11	2.6
	Manhattan, 1920	580	11	1.8	533	4	.7
	Pullman, 1920				270	0	0
	Brooklyn, 1921	79	0	0	54	0	0
	Brooklyn, 1922	368	2	.5	482	14	2.8

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sterilis—Continued.							
Burt, S. N. 254, C. I. 293	Aberdeen, 1920	95	2	2.1			
	Brooklyn, 1921	98	11	11.2	95	4	4.2
	Brooklyn, 1922	107	1	.9	72	1	1.3
Burt, S. N. 339 (a commercial strain).	Ames, 1920	113	3	2.6	124	1	.8
	Aberdeen, 1920	132	7	5.3	110	0	0
	Manhattan, 1920	193	4	2.0	247	0	0
	Brooklyn, 1921	205	5	2.4	134	5	3.7
	Brooklyn, 1922	86	0	0	68	2	2.9
Fulghum, S. N. 129	Columbia ②	305	0	0	273	2	.7
	Columbia, 1920	270	0	0	325	1	.3
	Ames, 1919	118	0	0	68	0	0
	Ames, 1920	665	0	0	629	1	.1
	Aberdeen, 1919	46	1	2.1	56	0	0
	Aberdeen, 1920	645	2	.3	408	2	.4
	Manhattan, 1920	862	6	.7	626	1	.1
	Pullman, 1920				129	0	0
Fulghum, S. N. 257, C.I. 708.	Brooklyn, 1921	488	2	.4	404	1	.2
	Brooklyn, 1922	715	1	.1	654	2	.3
	Columbia ①	194	4	1.9	218	3	1.3
	Columbia, 1920	212	1	.4	230	1	.4
	Ames, 1919	159	1	.6	256	1	.3
	Ames, 1920	831	2	.2	811	3	.3
	Aberdeen, 1919	210	0	0	228	1	.4
	Aberdeen, 1920	660	2	.3	529	0	0
	Manhattan, 1920	1,036	15	1.4	1,082	6	.6
	Pullman, 1920				316	1	.3
Fulghum (Kanota), S. N. 264, C. I. 839.	Brooklyn, 1921	640	8	1.2	441	2	.4
	Brooklyn, 1922	1,011	6	.6	960	2	.2
	Aberdeen, 1920	249	6	2.4	90	0	0
	Brooklyn, 1921	143	1	.6	109	1	.9
	Brooklyn, 1922	104	1	.9	132	1	.7
Fulghum (Kanota), S. N. 368.	Ames, 1920	124	0	0	132	0	0
	Aberdeen, 1920	158	2	1.3	82	2	2.4
	Manhattan, 1920	245	5	2.0	213	7	3.2
	Pullman, 1920				143	0	0
Italian Rustproof (selection), S. N. 260, C. I. 396-4.	Brooklyn, 1921	214	4	1.8	153	3	1.3
	Brooklyn, 1922	499	1	.2	503	3	.5
	Columbia ①	60	2	3.3	65	3	4.6
	Ames, 1920	47	1	2.1	39	0	0
	Aberdeen, 1920	69	5	7.2			
Var. nigra, S. N. 130	Brooklyn, 1921	90	6	6.6	81	3	3.7
	Brooklyn, 1922	98	0	0	88	2	2.2
	Columbia ①	26	0	0	37	0	0
	Ames, 1919	62	0	0	54	0	0
	Aberdeen, 1920	45	0	0			
	Pullman, 1920				33	0	0
Red Algerian, S. N. 256, C. I. 840.	Brooklyn, 1921	80	2	2.5	39	0	0
	Brooklyn, 1922	46	0	0	48	0	0
	Aberdeen, 1920	9	0	0			
Red Rustproof, S. N. 131	Columbia ①	19	2	10.5	24	4	16.6
	Aberdeen, 1920	42	0	0			
Red Rustproof, S. N. 262, C. I. 548-1.	Brooklyn, 1921	65	0	0	64	0	0
	Brooklyn, 1922	66	0	0	79	0	0
	Aberdeen, 1920	120	11	9.1			
	Brooklyn, 1921	74	9	12.1	62	2	3.2
	Brooklyn, 1922	69	0	0	78	0	0
Red Rustproof, S. N. 263, C. I. 775.	Columbia, 1920	45	1	2.2	45	0	0
	Ames, 1919	84	0	0	124	0	0
	Ames, 1920	83	0	0	66	0	0
	Aberdeen, 1919	96	0	0	99	0	0
	Aberdeen, 1920	164	0	0	100	0	0
	Manhattan, 1920	504	3	.5	416	6	1.4
	Pullman, 1920				172	0	0
Red Rustproof (Hastings), S. N. 265, C. I. 884.	Brooklyn, 1921	184	0	0	142	1	.7
	Brooklyn, 1922	55	0	0	62	0	0
	Ames, 1919	116	1	.9	106	0	0
	Aberdeen, 1920	185	2	1.1	72	0	0
	Brooklyn, 1921	51	1	1.9	47	0	0
	Brooklyn, 1922	62	1	1.6	51	0	0

TABLE 2.—*Results of inoculating seed of varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis at the stations and in the years indicated*—Continued

Species, variety, and strain of oats	Station and year	Plants from seeds inoculated with—					
		Ustilago avenae			Ustilago levis		
		Total number	Infected		Total number	Infected	
			Number	Per cent		Number	Per cent
Avena sterilis—Continued.							
Red Rustproof, S. N. 338	Ames, 1920	71	0	0	86	1	1.1
	Aberdeen, 1920	74	2	2.7	109	3	2.7
	Manhattan, 1920	127	1	.7	64	2	3.1
	Brooklyn, 1921	52	2	3.8	47	1	2.1
Red Rustproof, S. N. 354, C. I. 518-3.	Ames, 1920	82	0	0	58	2	3.4
	Aberdeen, 1920	108	5	4.6	50	1	2.0
	Manhattan, 1920	136	12	8.8	60	0	0
	Pullman, 1920				97	4	4.1
	Brooklyn, 1921	54	7	12.9	43	5	11.6
	Brooklyn, 1922	86	1	1.1	75	2	2.6
Red Rustproof (Ferguson No. 71), S. N. 355.	Aberdeen, 1920	483	0	0	473	2	.5
	Manhattan, 1920	703	1	.1	605	5	.8
	Pullman, 1920				184	0	0
	Brooklyn, 1921	726	0	0	589	0	0
	Brooklyn, 1922	43	0	0	54	0	0
Selection (of Etheridge), S. N. 132, C. I. 1859.	Columbia ②①	140	6	4.2	120	8	6.6
	Columbia, 1920	75	0	0	90	1	1.1
	Ames, 1920	181	3	1.6	147	7	4.7
	Aberdeen, 1919	101	4	3.9	74	6	8.1
	Aberdeen, 1920	117	0	0	101	0	0
	Manhattan, 1920	135	0	0	119	0	0
	Pullman, 1920				82	0	0
Turkish Rustproof, S. N. 267, C. I. 356.	Brooklyn, 1921	155	0	0	125	0	0
	Brooklyn, 1922	66	0	0	56	0	0
	Columbia ①	50	0	0	54	0	0
	Ames, 1919	54	0	0	89	0	0
	Ames, 1920	64	2	3.1	103	1	.9
	Aberdeen, 1919	26	0	0	25	1	4.0
	Aberdeen, 1920	41	1	2.4	92	0	0
	Manhattan, 1920	105	10	9.5	109	0	0
	Pullman, 1920				49	0	0
Turkish Rustproof (selection), S. N. 268, C. I. 356-12.	Columbia ①	48	0	0	50	2	4.0
	Ames, 1919	30	1	3.3	53	4	7.5
	Aberdeen, 1920	68	4	5.8			
	Brooklyn, 1921	47	3	6.3	42	7	16.6
Avena strigosa: S. N. 29	Columbia ②④	565	0	0	537	0	0
	Columbia, 1920	130	0	0	160	0	0
	Ames, 1919	248	0	0	67	0	0
	Ames, 1920	509	0	0	422	0	0
	Aberdeen, 1919	211	0	0	166	0	0
	Aberdeen, 1920	60	0	0	86	0	0
	Manhattan, 1920	63	0	0	58	0	0
	Pullman, 1920				106	0	0
S. N. 76	Brooklyn, 1921	67	0	0	53	0	0
	Brooklyn, 1922	112	0	0	55	0	0
	Columbia ④②	467	0	0	268	0	0
	Aberdeen, 1919	82	0	0			
	Aberdeen, 1920	153	0	0	96	0	0
	Pullman, 1920				56	0	0
S. N. 133	Brooklyn, 1921	95	0	0	90	0	0
	Brooklyn, 1922	427	0	0	368	0	0
	Columbia ③	215	0	0	205	0	0
	Columbia, 1920	70	0	0	70	0	0
	Ames, 1919	157	0	0	53	0	0
	Ames, 1920	218	0	0	198	0	0
	Aberdeen, 1919	133	0	0	57	0	0
	Aberdeen, 1920	323	0	0	67	0	0
	Manhattan, 1920	255	0	0	459	0	0
	Pullman, 1920				107	0	0
S. N. 177, C. I. 1782	Brooklyn, 1921	425	0	0	352	0	0
	Aberdeen, 1920	62	0	0			
	Brooklyn, 1921	95	0	0	97	0	0

DISCUSSION OF RESULTS

On examining Table 2 it is evident that there was a great deal of variation in the degree of infection of the different varieties at the different stations and during the different years. There is considerable evidence that the results at Columbia in 1920 were somewhat lower than those for the previous years. There are indications also that the results at Ames and Aberdeen in 1919 were somewhat lower than those obtained in 1920. There are sufficient cases, however, in which the results with certain varieties were higher in 1919 than in 1920 to prevent definite conclusions. On the other hand, the results at Brooklyn in 1922 were notably lower than those obtained in 1921. This was particularly true with the varieties inoculated with *Ustilago avenae*. A partial explanation of this fact is found in the results of germination studies on the spores of *U. avenae*, in which very poor germination was obtained when compared with that of *U. levis*.

RESULTS FROM AVENA BREVIS

Six strains of *Avena brevis* Roth were grown in the course of the experiments, five of which, S. N. 1, 77, 134, 139, and 142, were entirely similar in their morphological features. Strain S. N. 289 matured several days later than the other five. It also differed in other minor features, so that it could be readily distinguished.

Of the first five strains, 4,390 plants [5] were grown in the experiments with *Ustilago avenae* and 3,734 plants in the experiments with *U. levis*. A single smutted head of S. N. 142 was recorded at Manhattan, but it may be doubted whether this head was actually that of *A. brevis*, as no special care was taken to preserve the plant on which it was observed. In every other case these strains of *A. brevis* proved entirely free from smut.

The late-maturing strain, S. N. 289, was grown at all the stations. At Brooklyn in 1921 2 plants out of a total of 87 in the *Ustilago levis* plat were found infected, and in 1922 in the same plat 2 plants out of a total of 454 showed infection. There can be no doubt about the identity of these plants, for in practically every case they were only partially smutted, thus making their identification possible.

At the other stations 475 plants were grown from the seed inoculated with *Ustilago levis* and 219 plants in the series inoculated with *U. avenae*, but none was found infected.

It is evident from the results that *Avena brevis* is extremely resistant to both smuts. However, some strains occasionally may be infected.

RESULTS FROM AVENA FATUA

Three strains (S. N. 143, 290, and 375) of *Avena fatua* L., the wild species of Avena, were grown, and all proved highly susceptible to both smuts. Infections up to 40 per cent or more were common, varying with the year and the station. Examination of the results indicates a slightly greater susceptibility to *Ustilago levis* than to *U. avenae*, as higher percentages of infection were obtained from the covered smut.

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[5] Since the data at Manhattan, Kans., are based on panicle counts and not on plant counts, the figures for that station are omitted from these and subsequent totals.

RESULTS FROM AVENA LUDOVICIANA

Five strains of *Avena ludoviciana* Dur. have been grown. Three of these strains (S. N. 80, 176, and 180) are moderately susceptible, especially to *Ustilago levis*. The results, however, have been quite variable at the different stations in different years. Strain S. N. 291 has proved to be somewhat more susceptible than the other three, showing higher percentages of infection. The fifth strain, S. N. 72, proved to be highly resistant. It is characterized by a prostrate habit in early growth. It was received under the name of *Avena sulcata* F. Gay.

RESULTS FROM AVENA NUDA

Two strains (S. N. 181 and 293) of the awned type of naked oats (*Avena nuda* L.) were grown and both proved to be highly susceptible. With rare exceptions the infection was always above 80 per cent and occasionally percentages of 90 to 100 were recorded.

Five additional strains of *Avena nuda* were grown, namely, *inermis* (S. N. 26, 30, 144, and 294) and Liberty (S. N. 292). These varieties also proved highly susceptible, commonly showing 80 per cent or more of infection. The results from Liberty, a cross between a naked oat and Swedish Select, were slightly lower than from the other varieties. The Liberty variety, while quite susceptible to both smuts, usually does not show percentages of infection as high as those obtained on the other naked oats.

The results clearly indicate that all strains and varieties of *Avena nuda* are extremely susceptible to both loose and covered smut.

RESULTS FROM AVENA SATIVA

In the course of the experiments more than 90 varieties of *Avena sativa*, represented by 182 strains, were grown. Based upon the percentages of infection these different strains and varieties fall into several groups. The first group includes the varieties which may be described as immune from or highly resistant to both smuts. The number of varieties included in this group is comparatively small. The list is given in Table 3.

TABLE 3.—*List of varieties and strains of Avena sativa found to be highly resistant to both loose and covered smuts of oats*

Variety or strain	Seed No.	Variety or strain	Seed No.
Belyak	306	Joanette	187
Black Mesdag	70, 117, and 188	Monarch	215
Caucasus	279	Var. mutica	45
Culberson	295	Pringle Progress	218
Danish Island	311	Siberian	323

Black Mesdag, represented by three strains (S. N. 70, 117, and 188), has proved to be practically free from infection. A total of 7,237 plants in the experiments with *Ustilago avenae* and 6,435 plants in the experiments with *U. levis* has been grown at all the different stations. At Manhattan and Ames a doubtful infection of this variety has been recorded. Unfortunately, plants were not preserved for final identification. Out of a total of 2,288 plants in the series inoculated with *U. avenae* grown at Brooklyn 4 were found infected.

In the series inoculated with *U. levis*, a total of 1,893 plants was grown at Brooklyn, but none was infected. The infected plants were all found in 1921, and there can be no doubt as to their identity. The variety, however, has proved consistently to be highly resistant.

A second group includes those strains and varieties which had a low percentage of infection, varying from less than 5 to about 20. Occasionally negative results were obtained, and in a few cases the percentage of infection at a particular station in one season exceeded 20. The varieties included in this list are shown in Table 4.

TABLE 4.—*List of varieties and strains of Avena sativa found to be moderately resistant to both loose and covered smuts of oats*

Variety or strain	Seed No.	Variety or strain	Seed No.
Var. aristata	35	Iowar	397
Var. aurea	7, 328	Irish Victor	204
C. I. No. 606	127	Joanette	125, 208
Cornellian	398	Kherson	209
Culberson	360	Lincoln	212
Early Mountain	201	Var. mutica	50, 51, 286
Early Mountain No. 2	273	Richland	281
Green Russian	121	Var. setosa	14
Hatchett	296	Sixty-Day Selection	167
Hay	317		

A third group includes those varieties which are moderately susceptible to both smuts. The degree of infection usually ranges between 20 and 40 per cent, rarely falling below 20 or rising above 40. This list is a long one, as shown in Table 5, and includes most of the varieties and strains of *Avena sativa*.

TABLE 5.—*List of varieties and strains of Avena sativa found to be moderately susceptible to both loose and covered smuts of oats*

Variety or strain	Seed No.	Variety or strain	Seed No.
Abundance	269	Montana	10
Albion	270	Var. mutica	43,44,47,49,53,54,56,58
Awnless Probsteier	114	Var. nigra	60
Banner	271	North Finnish	123, 184
Belyak	115, 321	Old Island Black	163, 217
Big Four	272, 307	Var. praegravis	63
Black American	185	Ruakura Rustproof	266
Var. brunnea	8	Siberian	282
Clydesdale	191	Silvermine	164, 199, 220, 221, 319
Culberson	120, 192	Silvermine (selection)	165
Culberson (selection)	194, 344	Sixty-Day	223, 224
Daubeney	195	Swedish Select	168, 225–228
Early Dakota	151	Tobolsk	232
Garton	153	Victory	283, 364
Golden Fleece	315	Wernich Golden	324
Green Russian	276, 313	White Bonanza	325
Heavyweight Champion	318	White Maine	234, 326
Irish Victor	155	Winter Turf	Various numbers and selections.
Kherson	158		
Var. krausei	9	Wisconsin Pedigree	365
Ligowa	277	Wisconsin No. 1	366
Lincoln	160, 210, 211, 213, 278		

A fourth group includes a few varieties which may be described as very highly susceptible to both loose and covered smut. As a rule, percentages of infection of 40 or higher are obtained. The varieties and numbers are given in Table 6.

TABLE 6.—*List of varieties and strains of Avena sativa found to be highly susceptible to both loose and covered smuts of oats*

Variety or strain	Seed No.	Variety or strain	Seed No.
Canadian	119, 190	June	157
C. I. No. 603	146	Kherson (selection)	159
Danish Island	310	North Finnish	216
Early Champion	150, 197	Var. praegravis	13, 61, 62
Golden Drop	154	Probsteier	219
Golden Rain	202, 275	Silvermine	222
Var. grisea	41	Silvermine (selection)	165, 231
Irish Victor	205	Sixty-Day	166
Japan (selection)	156	Victor	126, 233

A fifth group includes several varieties which usually have had higher percentages of infection from *Ustilago avenae* than from *U. levis*. The varieties included in this group are given in Table 7.

TABLE 7.—*List of varieties and strains of Avena sativa which usually have had higher percentages of infection from Ustilago avenae than from U. levis*

Variety or strain	Seed No.	Variety or strain	Seed No.
Aurora	183	Irish Victor	206
Bicknell (selection)	341, 342	Japan	207
Black Diamond	116	Lincoln	212, 214
Black Mogul	189	Monarch (selection)	162
Black Norway	118, 186	Var. mutica	11, 42, 46, 52, 57, 331
C. I. No. 602	145	Nebraska No. 21	280
Culberson	359	Var. nigra	12, 59
Culberson (selection)	193, 345	Rossman	322
Danish	309	Scottish Chief	124
Danish Island	149	Swedish Select	229
Dwarf Culberson	196	Var. trisperma	64
Early Gothland	152, 200	White Queen	327
Green Russian	316		

In some cases the variety is only slightly or moderately susceptible to the loose smut, and the difference in the behavior of the variety to the two smuts is not so evident. In other cases the difference between the percentage of infection with loose smut and with covered smut is very marked.

The sixth and final group includes five varieties which appear to be somewhat more susceptible to *Ustilago levis* than to *U. avenae*, although the differences are not so evident. These varieties and their seed numbers are as follows: C. I. No. 620 (S. N. 148), Green Russian (S. N. 203, S. N. 314), Monarch (S. N. 161), Silvermine (S. N. 303), and Tobolsk (S. N. 122).

Although the *Avena sativa* group as a whole consists of varieties susceptible to both smuts, it is important to note the occurrence of a few varieties remarkably free from smut infection. Black Mesdag possesses a very high degree of resistance, while Siberian (S. N. 323) has as good a record but has not been grown so long.

RESULTS FROM AVENA SATIVA ORIENTALIS

The tests included 24 distinct varieties of side oats (*Avena sativa orientalis* L.). Practically all of these have shown high percentages of infection. Infections of 40 per cent or more were common. The var. *obtusata* (S. N. 33) and var. *tartarica* (S. N. 5) were much less susceptible than the other varieties. Variety *mutica* (S. N. 32)

appears to be highly susceptible to *Ustilago avenae* but somewhat resistant to *U. levis*.

As a group the side oats are extremely susceptible to both smuts, and no other striking cases of resistant varieties have been discovered.

RESULTS FROM AVENA STERILIS

Four strains of the wild species (*Avena sterilis* L.) have been grown. These strains are closely related to *Avena ludoviciana*. Two of them (S. N. 27 and S. N. 28) have proved to be moderately susceptible. The results have varied considerably from year to year and at the different stations. A third strain (S. N. 252) has had comparatively high percentages of infection in the one year in which it was grown at Aberdeen, Idaho. S. N. 128 has had lower percentages of infection in the one year at Aberdeen and one year at Brooklyn.

Ten cultivated varieties of the *Avena sterilis* type have been grown. Seven different strains of Burt (S. N. 67, 74, 75, 175, 253, 254, and 339) have been grown. S. N. 67 has had comparatively low percentages of infection, especially with *Ustilago levis*, except at Aberdeen in 1919 and at Columbia in 1920. S. N. 74 has shown considerably higher percentages of infection. S. N. 75, received under the name of Early Ripe, usually has shown low percentages of infection, the important exceptions being at Aberdeen in 1919 and Ames in 1920. S. N. 175 and S. N. 253 consistently have had very low percentages of infection. Strain S. N. 254 had rather high infection at Brooklyn in 1921. S. N. 339 has given results slightly above the average for the other strains. This strain, however, was from a commercial source and may not have been a pure Burt variety; no special effort was made to establish a pure-line Burt in it.

Four different strains of Fulghum (S. N. 129, 257, 264, and 368) were grown. S. N. 129 was obtained from Etheridge under the name of King. S. N. 264 and S. N. 368 are known as Kanota, a strain of Fulghum distributed by the Kansas Agricultural Experiment Station. A total of 3,252 plants of Fulghum (S. N. 129) was grown from the seed inoculated with *Ustilago avenae*. Of these, only 6 plants were infected. In the series inoculated with *U. levis* 2,946 plants were grown, of which 9 were infected. Fulghum (S. N. 257) has almost as good a record, as only 24 plants out of a total of 3,917 in the *U. avenae* series and only 14 plants out of a total of 3,989 in the *U. levis* series were infected. The two strains of Kanota (S. N. 264 and S. N. 368) developed only 15 infected plants out of a total of 1,491 after inoculation with *U. avenae* and 10 infected plants out of a total of 1,344 after inoculation with *U. levis*.

Seven different strains of Red Rustproof oats have been grown. Strains S. N. 131, 262, 338, and 354 have given slightly variable results, but on the whole the percentages of infection have been small. On the other hand, strains S. N. 263, 265, and 355 have given consistently low percentages of infection.

All the other varieties of *Avena sterilis* grown, namely, Black Algerian (S. N. 261), Red Algerian *culta* (S. N. 256), *nigra* (S. N. 130), and Selection (S. N. 132), have proved resistant, although in some cases the number of plants obtained was relatively small. A selection from Italian Rustproof (S. N. 260) has given low per-

centages of infection. Turkish Rustproof (S. N. 267) has shown a high degree of resistance to both smuts, but the selection from Turkish Rustproof (S. N. 268) seems to be somewhat more susceptible.

The cultivated strains and varieties of *Avena sterilis* have shown a remarkable degree of resistance to both loose and covered smut. It is especially striking that such important commercial varieties as Burt and Fulghum (including Kanota) possess a very high degree of resistance to the smuts. On the other hand, it is noteworthy that the wild types and the closely related species *A. ludoviciana* are moderately susceptible to both *Ustilago avenae* and *U. levis*.

RESULTS FROM AVENA STRIGOSA

Four strains (S. N. 29, 76, 133, and 177) of *Avena strigosa* Schreb. were grown. In the experiments with *Ustilago avenae*, 4,824 plants were grown and in those with *U. levis* 3,736 were grown. No infected plants were observed. Evidently all the strains used were highly resistant to both smuts.

Mrs. Lucille K. Bartholomew, in her experiments with certain varieties of oats while in the Office of Cereal Investigations, succeeded in producing infection in a single plant of *Avena strigosa* (unpublished data). There can be no question as to the identification of the plant, because it was only partially smutted.

It is interesting to compare the results with those obtained by Vavilov (*20*). He grew in his experiments four different strains of *Avena strigosa* and found that three were immune from *Ustilago avenae*. The fourth strain, however, had a considerable percentage of infection. He found that this strain differed genetically from the other three, as it would cross readily with the ordinary types of Avena. Stapledon (*18*) and Sampson and Davies (*15*) record the occurrence of smut in the Orkney Strigosa. It is evident that there are distinct strains of *A. strigosa* that are more or less susceptible to the smuts. These may all differ genetically, however, and may have the *sativa* type in their ancestry.

GREENHOUSE EXPERIMENTS

It is evident from the data presented that very great differences are found in the susceptibility of oats to *Ustilago avenae* and *U. levis*. In order to examine more closely the behavior of some resistant varieties, experiments were conducted in the greenhouse in 1919, 1920, and 1921. Several of the most resistant varieties, together with a number of extremely susceptible ones, were grown in these different years. The data are summarized in Table 8.

An examination of Table 8 shows clearly that varieties highly resistant under field conditions have maintained their resistance when grown in the greenhouse. These varieties include *Avena brevis* (S. N. 77 and S. N. 134); *A. ludoviciana* (S. N. 72); *A. sativa* var. Black Mesdag (S. N. 70 and S. N. 117); *A. sterilis* var. Burt (S. N. 175), var. Fulghum (S. N. 129 and S. N. 257), and var. Red Rustproof (S. N. 262); and *A. strigosa* (S. N. 133). *A. brevis* (S. N. 77) and *A. ludoviciana* (S. N. 72) gave entirely negative results in the field, but in the greenhouse experiments one plant of each was observed to be infected.

TABLE 8.—*Results of inoculating seed of several of the most resistant and extremely susceptible varieties and strains of different species of Avena with spores of Ustilago avenae and U. levis in the greenhouse in the years indicated*

Species and variety	S. N.	Year	Ustilago avenae			Ustilago levis		
			Number of plants	Infected		Number of plants	Infected	
				Number	Per cent		Number	Per cent
Avena brevis	77	1919	122	0	0	103	1	0.9
	134	1920	52	0	0	47	0	0
		1921	52	0	0	44	0	0
Avena fatua	143	1919	14	9	64.2	50	30	60.0
	290	1920	38	31	81.5	26	25	96.1
	72	1921	36	1	2.7			
Avena ludoviciana	180	1919	33	0	0			
	291	1920	58	8	13.7	44	30	68.1
Avena nuda:								
Var. biaristata	181	1919	76	76	100			
	293	1920	40	39	97.5	36	36	100
		1921	41	41	100	36	36	100
Var. inermis	30	1920	50	46	92.0	48	48	100
		1921	60	60	100	58	53	91.3
	144	1919	70	50	71.4	40	35	87.5
Liberty	292	1920	48	46	95.8	40	40	100
Avena sativa:								
Belyak	306	1921	58	4	6.8	64	2	3.1
Black Diamond	116	1919	29	2	3.4	49	2	4.0
Black Mesdag	70	1919	59	0	0			
		1920	55	0	0	54	0	0
		1921	56	0	0	53	0	0
	117	1919	63	0	0	85	0	0
		1920	49	0	0	54	0	0
		1921	60	0	0	55	0	0
Canadian	119	1920	53	47	88.6	55	54	98.1
		1921	60	50	83.3	54	35	64.8
Culberson	120	1919	84	7	8.3	70	3	4.2
Danish Island	311	1921	54	13	24.0	65	5	7.6
Early Champion	150	1920	30	24	80.0			
	197	1921	49	42	81.6	52	27	51.9
Green Russian	121	1920	42	26	61.9			
	316	1921	56	11	19.6	49	0	0
Kherson	158	1920	28	11	39.2			
Ruakura Rustproof	266	1919	57	2	3.5			
Silvermine	164	1920	7	3	42.8			
Swedish Select	168	1920	10	5	50.0			
Victor	126	1920	23	14	60.8			
		1921	49	38	77.5	49	36	73.4
Avena sativa orientalis:								
Black Tartar	108	1919	42	18	42.8	42	14	33.3
		1921	37	22	59.4	33	16	48.4
Green Mountain	110	1920	54	27	50.0	49	42	85.7
Avena sterilis:								
Burt	175	1919	60	0	0			
		1920	59	0	0	48	1	2.0
		1921	56	1	1.7	54	0	0
Fulghum	129	1919	61	0	0	48	0	0
		1920	55	3	5.4	46	2	4.3
		1921	52	0	0	54	0	0
	257	1919	49	0	0			
		1920	42	0	0	43	1	2.3
		1921	48	1	2.1	51	4	7.8
Red Rustproof	262	1920	22	0	0			
Avena strigosa	133	1920	48	0	0	35	0	0
		1921	52	0	0	47	0	0

The varieties that were extremely susceptible under field conditions also were severely attacked in the greenhouse cultures. These varieties were *Avena fatua* (S. N. 143 and S. N. 290); *A. nuda* var. *biaristata* (S. N. 181 and S. N. 293), var. *inermis* (S. N. 30 and S. N. 144), and var. Liberty (S. N. 292); *A. sativa* var. Canadian (S. N. 119), var. Early Champion (S. N. 150 and S. N. 197), var. Green Russian (S. N. 121), var. Silvermine (S. N. 164), var. Swedish Select (S. N. 168), and var. Victor (S. N. 126); *A. sativa orientalis* var. Black Tartar (S. N. 108)

and var. Green Mountain (S. N. 110). On the whole, the percentages of infection were somewhat higher in the greenhouse than in the field.

Certain varieties, *Avena ludoviciana* (S. N. 180) and *A. sterilis* var. Red Rustproof (S. N. 262), gave negative results in the greenhouse cultures, although infections usually occurred in the field. Moderately resistant varieties, such as *A. sativa* var. Black Diamond (S. N. 116), var. Ruakura Rustproof (S. N. 266), and var. Belyak (S. N. 306), gave about the same percentages of infection in the greenhouse as in the field trials. Danish Island (S. N. 311), which under field conditions showed only slight susceptibility to the smuts, gave rather high infections with *Ustilago avenae* in the greenhouse.

A special feature of the greenhouse infections was the vigor of the outbreak of the smut. In many cases the spores were developed not only in the floral parts but also on the upper leaves of the plant, resembling a characteristic leaf smut such as *Urocystis tritici* on wheat or *Ustilago striaeformis* on various grasses. In most cases these sori were found only on the upper or flag leaf; sometimes, however, one or more of the leaves just below the flag leaf also showed the same condition, but as a rule the sori on these were not so prominent nor extensive. These linear sori occurred on the blade of the leaf, rarely on the upper part of the sheath. The pustules were most numerous at the base of the blade, but frequently extended clear to the tip, forming long parallel striæ. In the early stages the spore masses were covered by the leaf tissue which soon ruptured and allowed the spores to escape. Very often the leaf, if severely attacked, was dwarfed. (Pls. II and III.) Several observers (*3*,*9*) have recorded this occurrence of the formation of spores on the leaves, and Verissimo d'Almeida and de Souza (*21*) have described a variety *foliicola* of *Ustilago avenae*. While this condition seems to be more prevalent in plants grown under greenhouse conditions, occasionally a similar condition is observed in plants grown in the field.

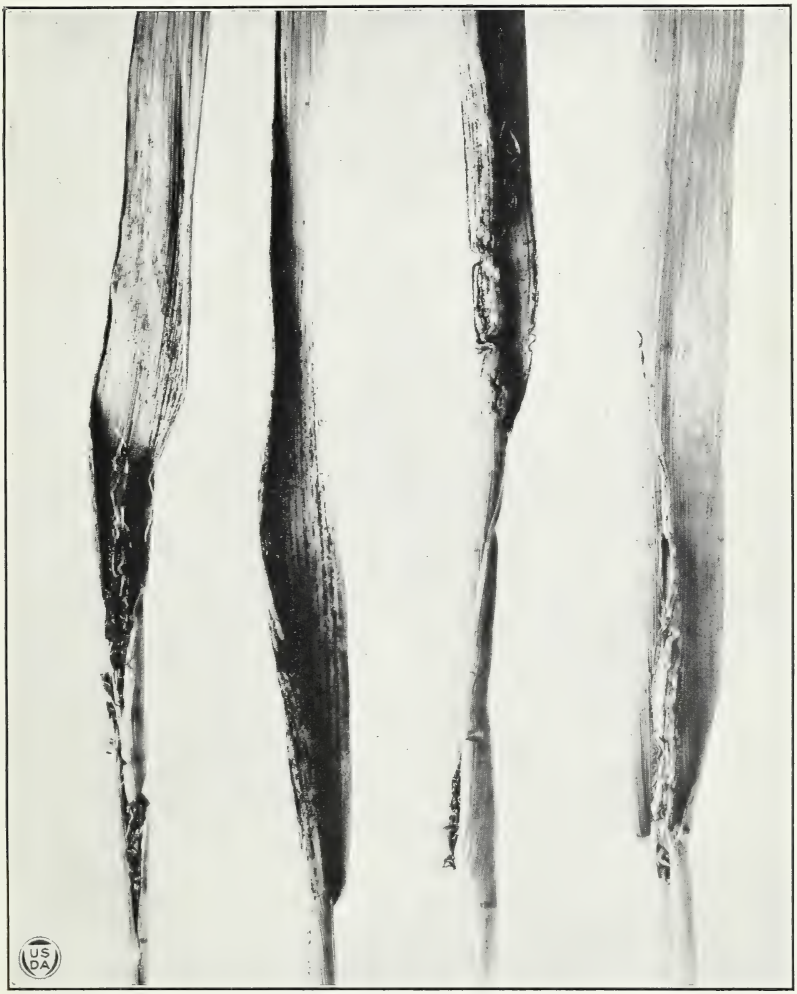
These leaf sori occur on plants infected both by *Ustilago avenae* and *U. levis*. Their occurrence seemed to be correlated somewhat with the susceptibility of the varieties. The strains of *Avena fatua*, *A. nuda*, and *A. sativa orientalis* var. Green Mountain were particularly conspicuous for the development of these sori on the leaves.

SUMMARY

Studies on the varietal resistance and susceptibility of oats to *Ustilago avenae* (Pers.) Jens. and *U. levis* (K. and S.) Magn. were carried out at Columbia, Mo., Ames, Iowa, Manhattan, Kans., Aberdeen, Idaho, Pullman, Wash., and Brooklyn, N. Y. Strains and varieties of *Avena brevis* Roth, *A. fatua* L., *A. ludoviciana* Dur., *A. nuda* L., *A. sativa* L., *A. sativa orientalis* L., *A. sterilis* L., and *A. strigosa* Schreb. were grown.

The strains and varieties at the widely separated stations gave, in general, similar results.

Six strains of *Avena brevis* were grown. Five of these were similar and gave negative results with both smuts, except in one doubtful case. Plants grown in the *Ustilago avenae* series numbered 4,390, and in the *U. levis* series they numbered 3,734. The remaining strain differed in maturing later and in other respects. Only four plants out of a total of 1,016 were observed to be infected with *U. levis*. Nega-



USTILAGO AVENAE (PERS.) JENS.—I

Leaf sori on *Avena nuda* L. var. *inermis* (two-thirds natural size)

USTILAGO AVENAE (PERS.) JENS.—II

Leaf sori on *Avena nuda* L. var. Liberty: *A*, Upper surface of leaf; *B*, lower surface of leaf enlarged 2 diameters

tive results were obtained with *U. avenae* in the total of 850 plants grown.

Three strains of *Avena fatua* were grown, and all proved susceptible.

Five strains of *Avena ludoviciana* were grown, and four of them proved moderately susceptible. The fifth strain was highly resistant.

Seven strains and varieties of *Avena nuda* were grown. These were all highly susceptible to both smuts.

Avena sativa was represented by over 90 varieties and 182 strains. These showed great variation in their susceptibility. A few proved to be very resistant, including Black Mesdag, Culberson (S. N. 295), Caucasus, Danish Island (S. N. 311), and Siberian (S. N. 323). A larger number proved to be highly susceptible, including Canadian, Early Champion, Golden Drop, Irish Victor, Japan Selection, June, North Finnish, Sixty-Day, and Victor. The greatest number of the varieties, however, may be placed in groups intermediate between these two extremes. Several varieties, including Bicknell ([selections] S. N. 341 and 342), Black Diamond, Danish, Danish Island (S. N. 149), Early Gothland, Rossman, and Scottish Chief, appeared to manifest a greater susceptibility to *Ustilago avenae* than to *U. levis*. The reverse seemed to be true in the case of C. I. No. 620 (S. N. 148), Green Russian (S. N. 203 and 314), Monarch (S. N. 161), and Tobolsk (S. N. 122).

All the varieties of *Avena sativa orientalis* appeared to be susceptible.

The wild forms of *Avena sterilis* were moderately susceptible to both smuts. The cultivated forms, such as Burt, Fulghum, Red Rustproof, and other varieties, possess a marked resistance to both smuts.

Avena strigosa was represented by four strains. No infected plants were observed, although 4,824 were grown in the series inoculated with *Ustilago avenae* and 3,736 in the series inoculated with *U. levis*.

A number of varieties were grown in the greenhouse. The results were quite comparable to those obtained in the field experiments. Resistant varieties maintained their resistance to both smuts, and susceptible varieties were attacked severely.

Under greenhouse conditions the formation of pustules of smut spores on the upper leaves of susceptible varieties was conspicuous in both *Ustilago avenae* and *U. levis*.

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